

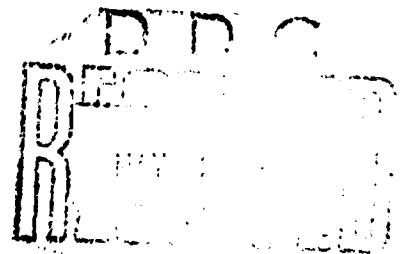
AD 740819

DNA 2714T
July 1971

THE VARIATION OF SHOCK FRONT PROPERTIES FROM A 1-KT. EXPLOSION WITH ALTITUDE

Edward J. Kownacki

Reproduced by
**NATIONAL TECHNICAL
INFORMATION SERVICE**
Springfield, Va 22151



HEADQUARTERS.
Defense Nuclear Agency
Washington, D.C. 20305



APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

31

ACCESSION NO.	
CFSTI	WHITE SECTION <input checked="" type="checkbox"/>
.30	BUFF SECTION <input type="checkbox"/>
E.C.L.	
RECEIVED DATE	
APRIL 11, 1968	
FEDERAL BUREAU OF INVESTIGATION U.S. DEPARTMENT OF JUSTICE	
BOSTON OFFICE	
APRIL 11, 1968 \$250	

Destroy this report when it is no longer needed. Do not return to sender.

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(See reverse side for classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporation author) Director Defense Nuclear Agency Washington, D.C. 20305		2d. REPORT SECURITY CLASSIFICATION UNCLASSIFIED
3d. GROUP		
3. REPORT TITLE The Variation of Shock Front Properties from a 1-kt. Explosion with Altitude		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Topical Report		
5. AUTHOR(S) (First name, middle initial, last name) Edward J. Kownacki		
6. REPORT DATE July 1971	7a. TOTAL NO. OF PAGES 46	7b. NO. OF REPS 5
8. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S) DNA 2714T	
9. PROJECT NO. c. d.	10. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
11. DISTRIBUTION STATEMENT Approved for public release; distribution unlimited.		
12. SUPPLEMENTARY NOTES	13. SPONSORING MILITARY ACTIVITY Director Defense Nuclear Agency Washington, D.C. 20305	
14. ABSTRACT <p>A computer program was developed to present shock front properties in the form of iso-values as functions of altitude of burst and range. This program consisted of a Sachs' scaling routine and a log-log interpolation routine. It was found that overpressure, density, and Rho-U decrease with increasing altitude; particle velocity, density ratio, pressure ratio, and shock strength increase with increasing altitude; thermal flux density and dynamic pressure remain relatively unchanged with increasing altitude.</p>		

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS
COMPLETE FOR ARMY USE.

UNCLASSIFIED
Security Classification

UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Nuclear explosions Shock front properties Altitude dependence Co-altitude explosions						

UNCLASSIFIED
Security Classification

DNA 2714T

July 1971

**THE VARIATION OF
SHOCK FRONT PROPERTIES
FROM A 1-KT. EXPLOSION
WITH ALTITUDE**

Edward J. Kownacki

**HEADQUARTERS
Defense Nuclear Agency
Washington, D.C. 20305**

**APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED**

THIS PAGE IS INTENTIONALLY LEFT BLANK.

ACKNOWLEDGMENT

This work was done at the request of and under the general direction of Mr. Jack R. Kelso.
The advice and assistance of Mr. Louis J. Belliveau is acknowledged.

ABSTRACT

A computer program was developed to present shock front properties in the form of isovales as functions of altitude of burst and range. This program consisted of a Sachs' scaling routine and a log-log interpolation routine. It was found that overpressure, density, and Rho-U decrease with increasing altitude; particle velocity, density ratio, pressure ratio, and shock strength increase with increasing altitude; thermal flux density and dynamic pressure remain relatively unchanged with increasing altitude.

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
Acknowledgment -----	iii
Abstract -----	iv
1 Introduction -----	1
2 Discussion -----	2
2-1. General -----	2
2-2. Shock front properties -----	2
2-3. Thermal flux density -----	2
2-4. Standard 1-kt. nuclear free air pressure-distance curve for sea-level conditions -----	2
2-5. Standard 1-kt. nuclear thermal flux-distance curve for sea-level conditions -----	2
2-6. Altitude corrections-Sachs' scaling -----	2
2-7. Energy partition for blast and thermal as a function of altitude -----	4
2-8. Presentation of shock front properties (Rankine-Hugoniot relations) versus altitude curves and thermal flux density versus altitude curves -----	7
2-9. Yield corrections -----	12
3 Conclusions -----	13
4 Bibliography -----	14
 Appendix	
I Interpolation scheme -----	15
II Fortran programs and printouts -----	17
A. Subroutine RP 1271 -----	18
B. Subroutine ARDC -----	19
C. Peak overpressure program -----	20
D. Peak overpressure printout -----	21
E. Dynamic pressure program -----	22
F. Dynamic pressure printout -----	23
G. Particle velocity printout -----	24
H. Density ratio printout -----	25
I. Rho-U printout -----	26
J. Pressure ratio program -----	27
K. Pressure ratio printout -----	28
L. Shock strength printout -----	29
M. Density printout -----	30
N. Thermal flux program -----	31
O. Thermal flux printout -----	32
Distribution list -----	33

LIST OF ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
2-1	1-kt., sea-level overpressure curve in the range 1,700 to 0.00016 p. s. i. -----	3
2-2	1-kt. thermal flux curve for sea-level conditions -----	3
2-3	Blast yield reduction with altitude -----	5
2-4	Thermal partition function for 1 kt. -----	5
2-5	Effective blast yield versus burst altitude -----	6
2-6	Free-field overpressure (p. s. i.) as a function of altitude and range -----	8
2-7	Dynamic pressure (p. s. i.) as a function of altitude and range -----	8
2-8	Particle velocity (ft./sec.) as a function of altitude and range -----	9
2-9	Density ratio as a function of altitude and range -----	9
2-10	Rho-U (slugs/(in. ² -sec.)) as a function of altitude and range -----	10
2-11	Pressure ratio as a function of altitude and range -----	10
2-12	Shock strength as a function of altitude and range -----	11
2-13	Density (slugs/(ft.-in. ²)) as a function of altitude and range -----	11
2-14	Thermal flux density (cal./cm. ²) as a function of altitude and range -----	12
3-1	Free-field overpressure (p. s. i.), thermal flux density (cal./cm. ²), and particle velocity (ft./sec.) for 1 kt. -----	13

SECTION 1

INTRODUCTION

The standard scientific presentation of weapons effects information is in the form of universal curves as in NOLTR-69-88¹ and EM-1.² For engineering purposes a presentation in the form of isovales in the desired quantities on a chart of altitude and damage ranges may provide a more significant insight into the altitude dependence of isovalue ranges. The obtaining of these preselected isovales is a standard and somewhat tedious problem in cross plotting and interpolation. Sachs' scaling and interpolation computer routines were obtained from NOL³ and modified to incorporate logarithmic interpolation.

¹ Lehto, E. L., and Larson, R. A. "Long Range Propagation of Spherical Shock Waves from Explosions in Air." NOLTR-69-88. (Unclassified)

² "Capabilities of Nuclear Weapons." EM-1. (Confidential)

³ Lehto, D. L., various private communications on computer programs for Sachs' scaling and interpolation schemes.

SECTION 2

DISCUSSION

2-1. GENERAL. Damage to aeronautical and missile systems within the sensible atmosphere (0 to 100,000 feet altitude) from nuclear weapons effects is expressible in terms of damage distances for damage environments, such as overpressure, dynamic pressure, thermal radiation, neutron and X-ray flux, etc. For some systems the dominant or largest damage distances are associated with hydrodynamic shock front properties or thermal radiation. These systems are generally aerodynamic vehicles, such as aircraft, cruise missiles, and low-altitude-point defense missiles, such as the 3T's, Nike, or Sprint.

2-2. SHOCK FRONT PROPERTIES. The hydrodynamic shock front properties of interest to aerodynamic vehicles can be defined by a system consisting of a sea-level, 1-kt. pressure-distance curve and a means of obtaining altitude and yield corrections to this basic curve.

2-3. THERMAL FLUX DENSITY. The thermal flux density (Q) is defined by the formula $Q = fWc/R^2$, where R is the range, f is the thermal partition function, W is the yield, and c is a constant containing dimension factors and the transparency factor (T) of the atmosphere (in our case $T = 1$, perfect transparency).

2-4. STANDARD 1-KT. NUCLEAR FREE AIR PRESSURE-DISTANCE CURVE FOR SEA-LEVEL CONDITIONS. The data for the 1 kt., sea-level overpressure curve was provided by two sources:

above 60 p.s.i., US59 (DASA 1200)

below 60 p.s.i., NOLTR 69-88.

This data is listed as Subroutine RP1271 and plotted in figure 2-1.

2-5. STANDARD 1-KT. NUCLEAR THERMAL FLUX-DISTANCE CURVE FOR SEA-LEVEL CONDITIONS. The thermal flux density formula used was $Q = 7.96 fW/R^2$, where 7.96 includes the transparency factor (l), the dimensionless factor $\frac{1}{4\pi}$, and the unit factor to give Q in terms of cal./cm.². The sea-level, 1-kt. thermal flux density is found plotted in figure 2-2.

2-6. ALTITUDE CORRECTIONS-SACHS' SCALING. The altitude corrections applied are the usual Sachs' scaling relationships:

$$\frac{\Delta P_1}{P_1} = \frac{\Delta P_2}{P_2}$$

When:

$$R_1 \left[\frac{P_1}{W_1} \right]^{1/3} = R_2 \left[\frac{P_2}{W_2} \right]^{1/3}$$

Where:

ΔP_1 and ΔP_2 are overpressures for point 1 and point 2, respectively, P_1 and P_2 are the respective atmospheric pressures, R_1 and R_2 are the respective ranges, and W_1 and W_2 are the respective yields.

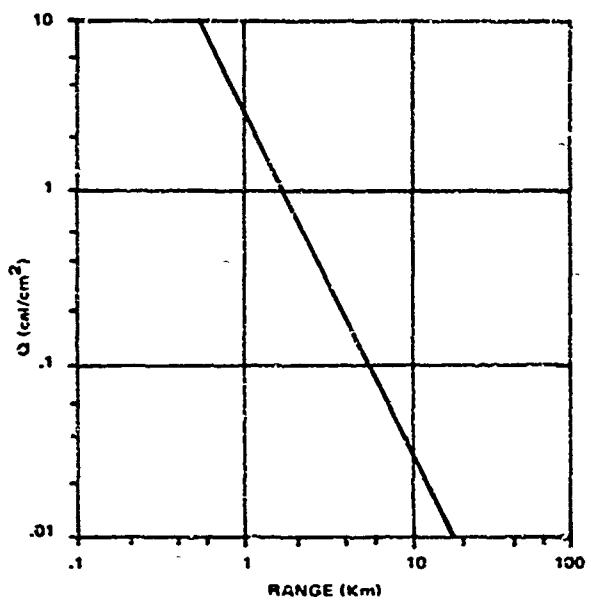


Figure 2-1. -- 1-kt., sea-level overpressure curve
in the range 1,700 to 0.00026 p. s. i.

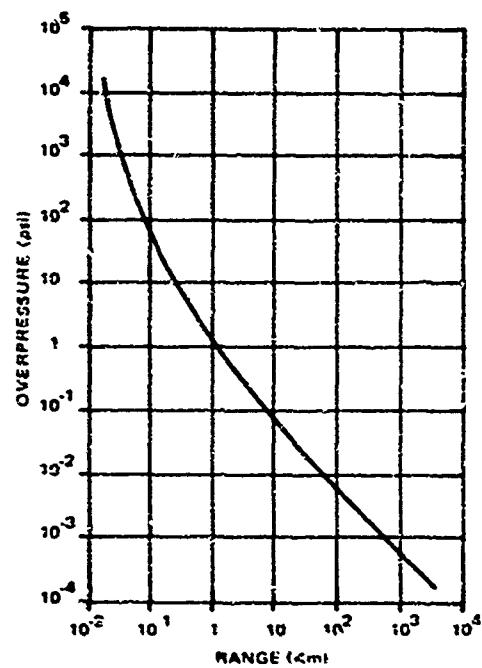


Figure 2-2. -- 1-kt. thermal flux curve
for sea-level conditions.

2-6.1 Subroutine ARDC provides pressure, temperature, and density of the standard atmosphere. The data was provided by R. A. Minzer, K. S. W. Champion, and H. L. Pond in "The ARDC Model Atmosphere," 1959, Air Forces Surveys in Geophysics No. 115 (AFCRC-TR-59-267), Air Force Cambridge Research Center, August 1959.

2-6.2 Using the overpressure-range curve of Subroutine RP1271 as the base curve, and the atmospheric pressures generated by subroutine AKDC, the overpressures for any altitude and any corrected yield (in this exercise $W_1 = W_2$) can be calculated.

2-7. ENERGY PARTITION FOR BLAST AND THERMAL AS A FUNCTION OF ALTITUDE. The yield corrections which are applied are obtained from the more formally correct radiation-hydrodynamic computer code calculations. These corrections are, unfortunately, functions of yield, distance, and altitude; but, for the range of hydrodynamic front and thermal radiation variables of interest in this memorandum, the yield correction is assumed to be a simple function of altitude only. The simplifications used in this memorandum are straight-line approximations to the curves presented in EM-1, and are applied first to the overpressure dependent qualities, and then independently to the thermal radiation.

2-7.1 The blast yield reduction with altitude function was taken from the effects manual, "Capabilities of Nuclear Weapons," 1 January 1968, and the thermal partition function was taken from chapter 3, "Thermal Radiation Phenomena," KN-68-504(R), 26 May 1969. These two functions are found plotted as figures 2-3 and 2-4. Also plotted are the straight-line approximations which were used in the computer program.

2-7.2 These straight-line approximations were used mainly for the purpose of facilitating computer time. There is no simple functional dependence between altitude and the quantities, and so to avoid feeding in all the data points for every possible altitude, the straight-line approximation was adopted.

2-7.3 For the blast yield reduction curve, the greatest difference occurs around 80 ft., where there is a difference of 0.02 (approximately 2-percent error) between the curve and the approximation. The curve and the approximation agree quite well over the whole altitude range, the error being less than 1 percent over most of the range.

2-7.4 The blast yield reduction curve can be compared with a plot of the maximum computed effective blast yield in DASA 1200. This plot is shown in figure 2-5. The straight-line approximation used in the program was fitted to the curve, not to the envelope of figure 2-5, because in the altitude range of interest there are only two computations (at 105 ft.), and the curve intersects these points while the envelope does not. The function used is considered conservative for defense purposes, as in sure-survival studies on aircraft.

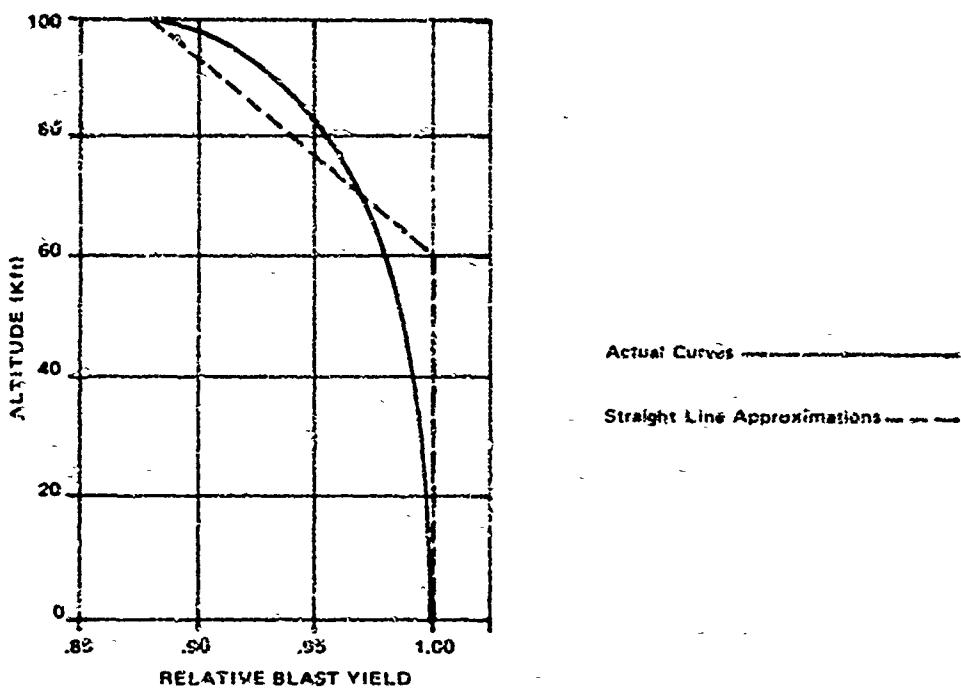


Figure 2-3. -- Blast yield reduction with altitude.

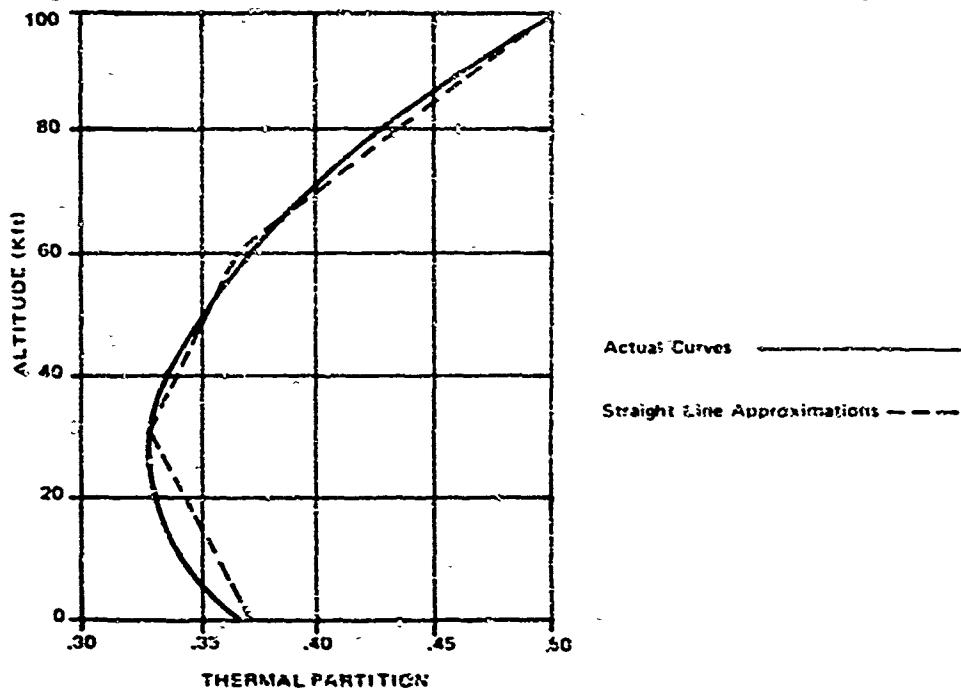


Figure 2-4. -- Thermal partition function for 1 kt.

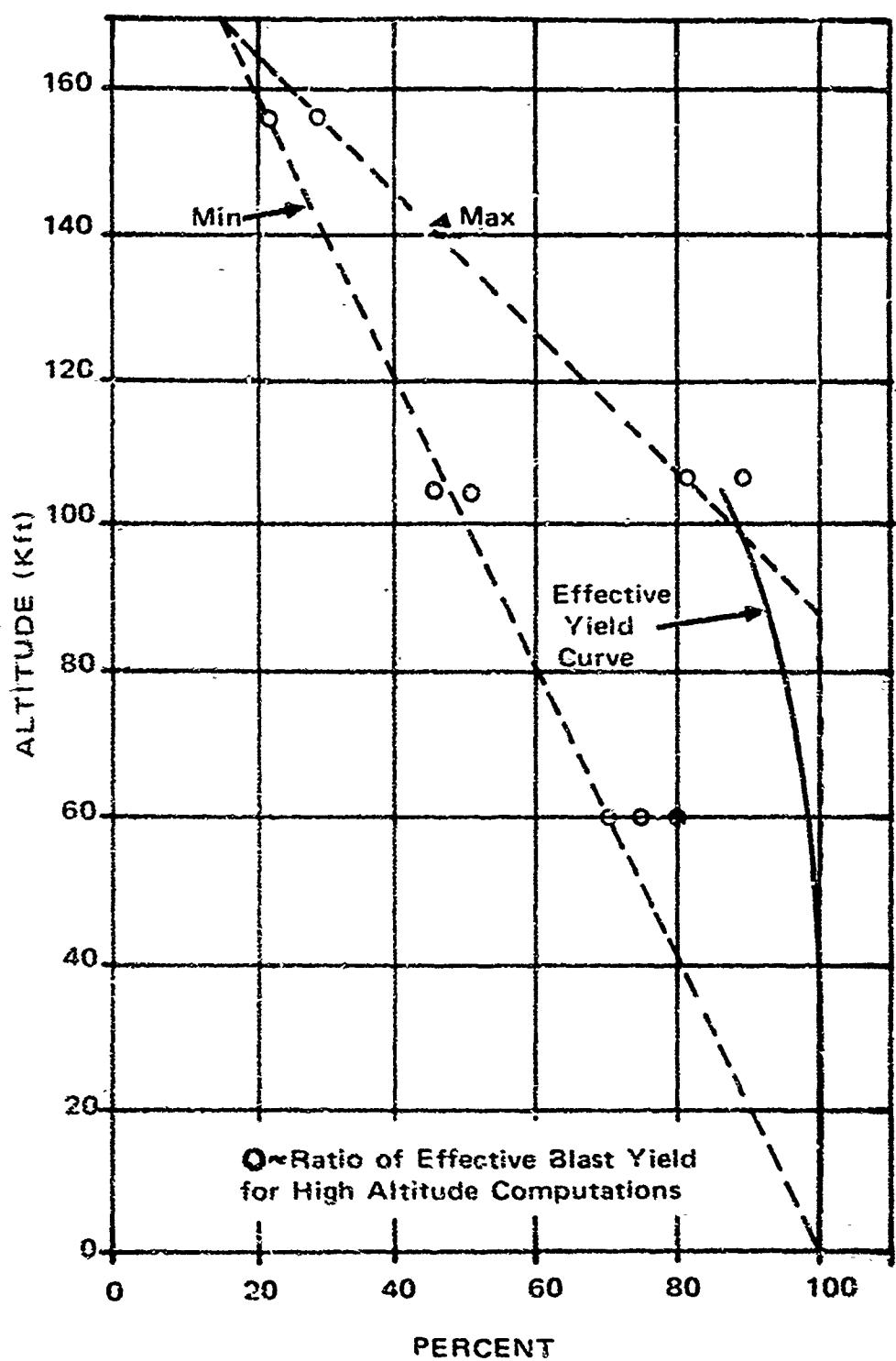


Figure 2-5. -- Effective blast yield versus burst altitude.

2-7.5 For the thermal partition function, the greatest difference occurs around 20 kft., where there is a difference of 0.01 (approximately 2-percent error) between the curve and the approximation. For the majority of altitudes, the error is less than 1 percent.

2-8. PRESENTATION OF SHOCK FRONT PROPERTIES (RANKINE-HUGONIOT RELATIONS) VERSUS ALTITUDE CURVES AND THERMAL FLUX DENSITY VERSUS ALTITUDE CURVES.

The Rankine-Hugoniot relations⁴ enable the calculation of density, density ratio, particle velocity, pressure ratio, shock strength, and dynamic pressure behind the shock front if the peak overpressure is given.

2-8.1 The program presented is not the most efficient program because a slight rearrangement of cards is necessary when changing from interpolation of one quantity to another (i.e., overpressure to dynamic pressure, density to thermal flux density, etc.). The card rearrangement is simple and straightforward and preferable to one gigantic, complex program that would just be nine programs added together. This simple card rearrangement can be seen in the sample programs presented in appendix II.

2-8.2 The peak overpressure isovales are presented in figure 2-6, the dynamic pressure isovales in figure 2-7, the particle velocity in figure 2-8, the density ratio in figure 2-9, the particle velocity \times density (Rho-U) in figure 2-10, the pressure ratio in figure 2-11, the shock strength in figure 2-12, and the density in figure 2-13.

2-8.3 All quantities were plotted from sea level to 100-kft. altitude, except for density, which is plotted only from sea level to 40 kft. in the most advantageous cases. The reason for this can be discerned by doing a few simple calculations.

2-8.4 The formula for density is $DENSITY = 0.0764575 \times DRATIO \times \frac{7 + 6 POVPA}{7 + POVPA}$ where $POVPA = \frac{OVP}{PSIAME}$. Since $DRATIO = 1$ at sea level, the minimum and maximum values of DENSITY are entirely dependent on the theoretical limits of OVP.

$$\text{If } OVP = 0, DENSITY = 0.076475$$

$$\text{If } OVP = \infty, DENSITY = 0.076475 \times 6 = 0.45825$$

$$\text{At } 50 \text{ kft., } DRATIO = \frac{0.011709}{0.076475}.$$

$$\text{Therefore, if } OVP = \infty, DENSITY = 0.076475 \times \frac{0.011709}{0.076475} \times 6 = 0.070254.$$

2-8.5 Since the highest possible value of DENSITY at 50 kft. is less than the lowest possible value of DENSITY at sea level, it is impossible to produce a plot that will have an altitude dependence from sea level to greater than 40 kft.

2-8.6 The thermal flux density isovales are presented in figure 2-14.

⁴ Glasstone, S. (ed.). "The Effects of Nuclear Weapons." 1964.

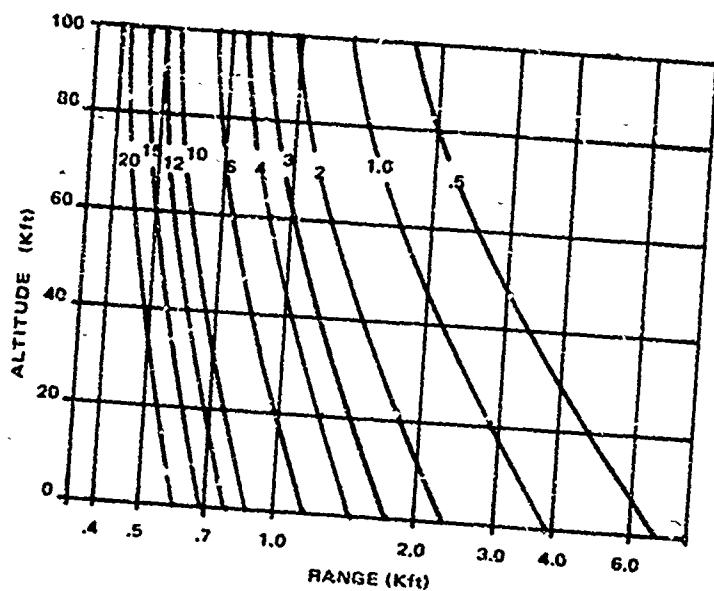


Figure 2-6. -- Free-field overpressure (p. s. i.) as a function of altitude and range.

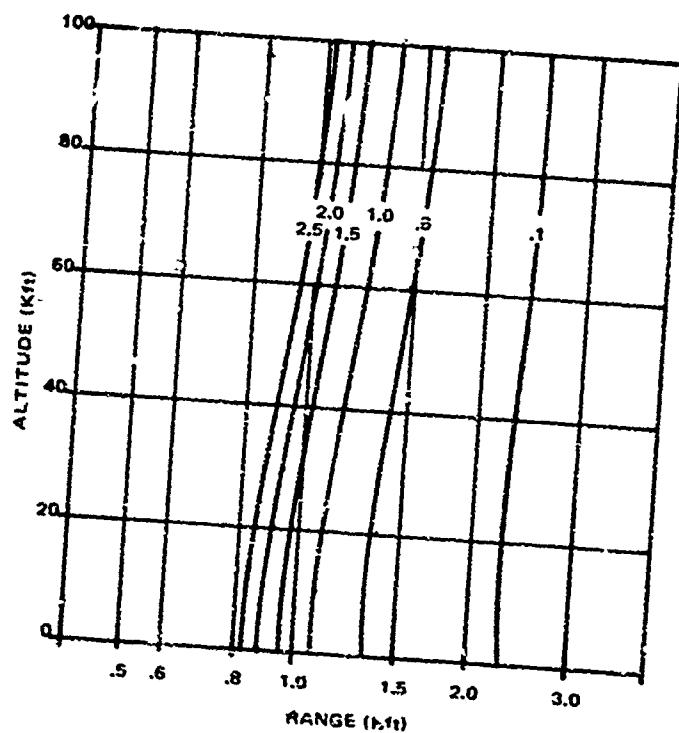


Figure 2-7. -- Dynamic pressure (p. s. i.) as a function of altitude and range.

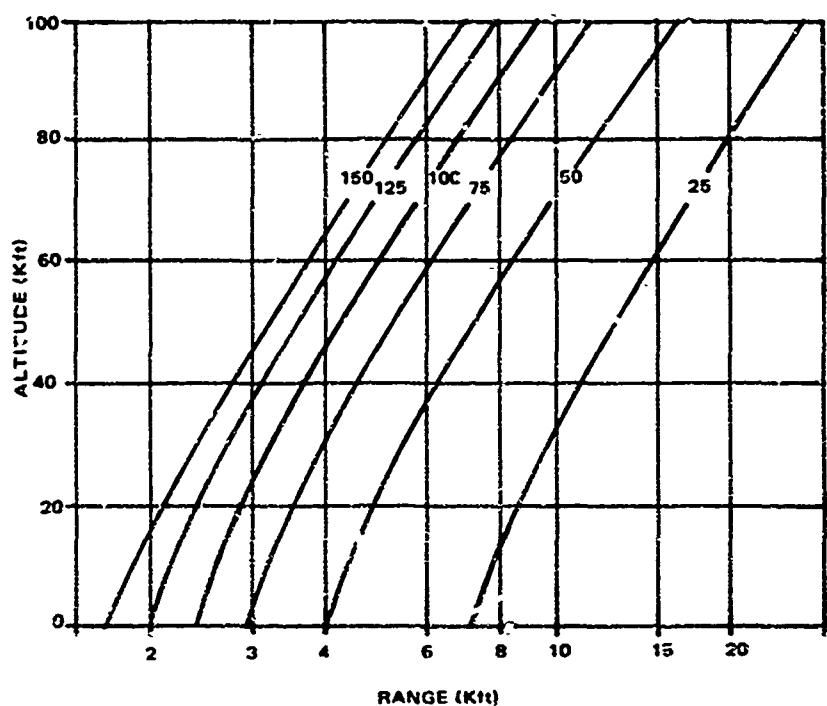


Figure 2-8. --Particle velocity (ft. /sec.) as a function of altitude and range.

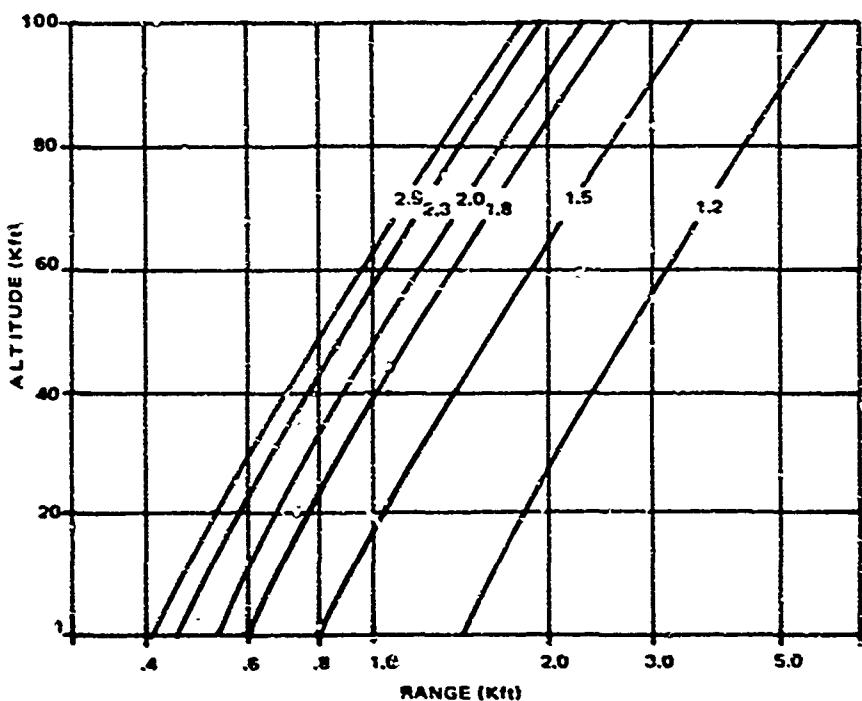


Figure 2-9. --Density ratio as a function of altitude and range.

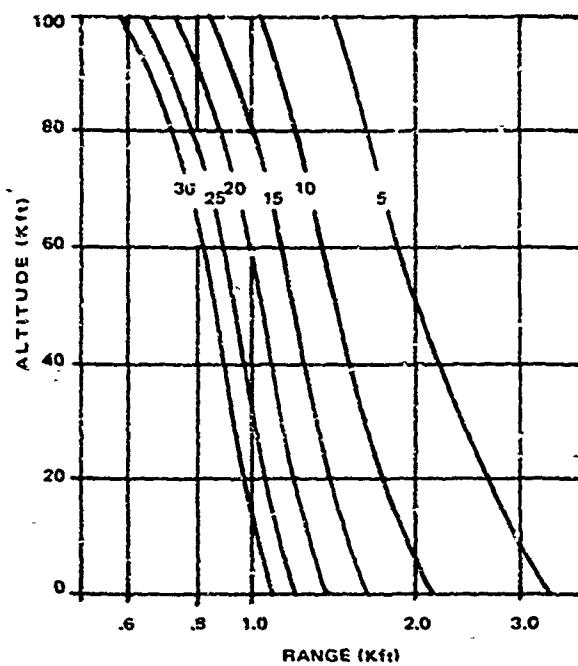


Figure 2-10. -- Rho-U (slugs/(in.²-sec.)) as a function of altitude and range.

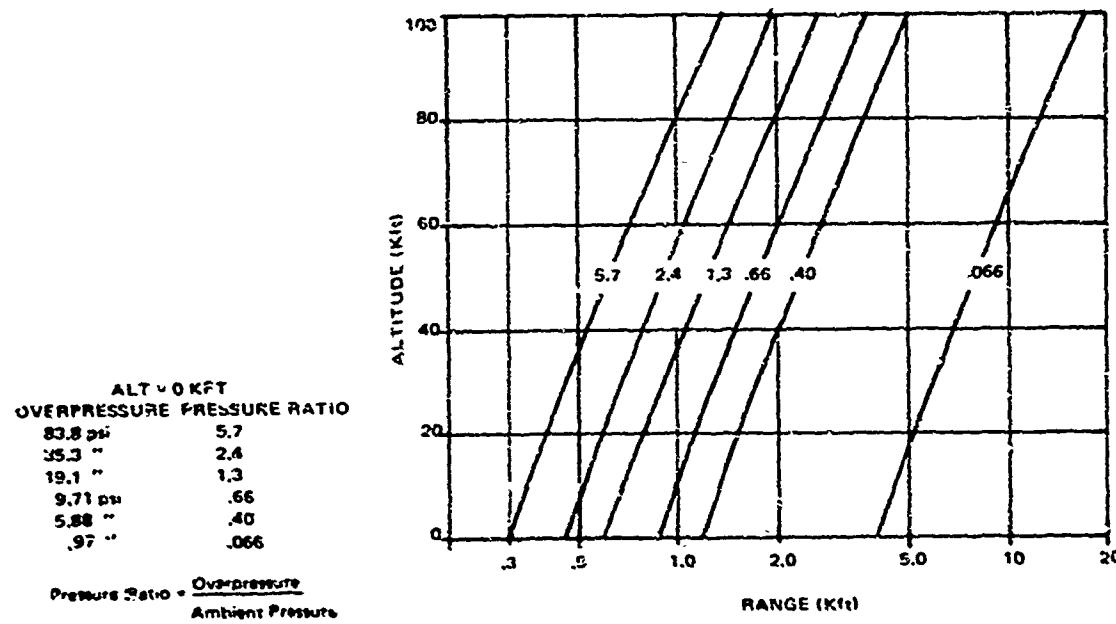


Figure 2-11. -- Pressure ratio as a function of altitude and range.

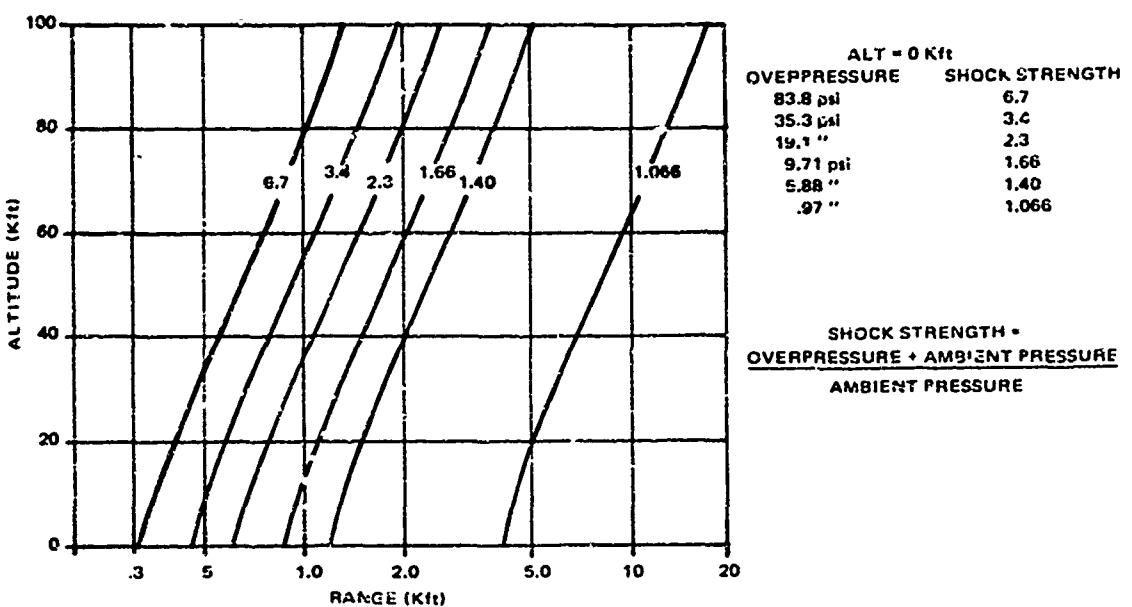


Figure 2-12. -- Shock strength as a function of altitude and range.

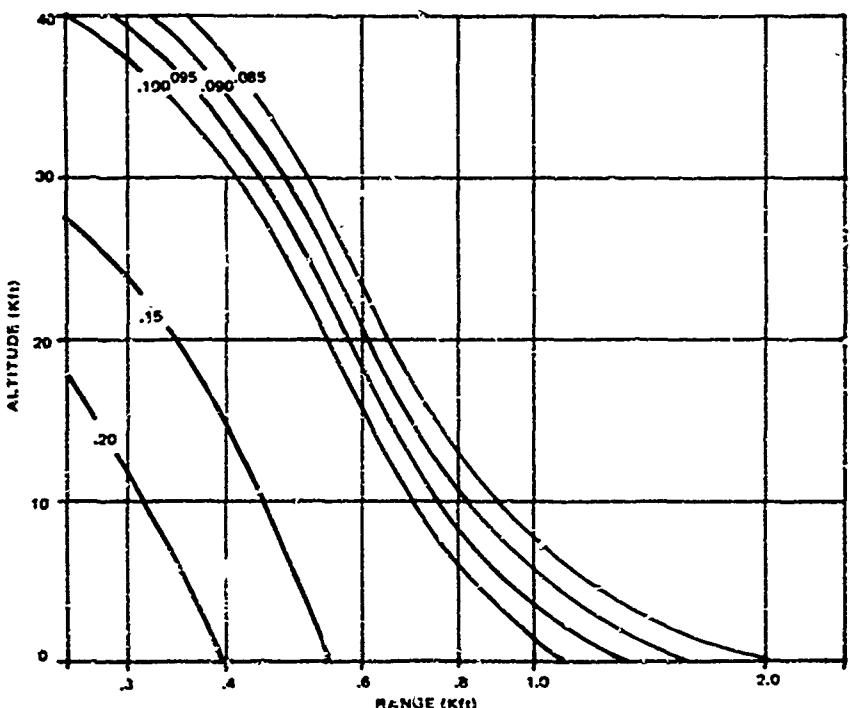


Figure 2-13. -- Density (slugs/(ft.-in.²)) as a function of altitude and range.

2-9. YIELD CORRECTIONS. Distance approximations for values of yield other than those presented in this memorandum may be obtained by multiplying the range by the cube root of the yield for hydrodynamic properties and the square root of the yield for thermal radiation. Discrepancies in the yield-correction factors are masked somewhat by the cube root and square root dependence, but very large yield variations may require more accurate estimates of the yield-corrections factor as presented in EM-1.

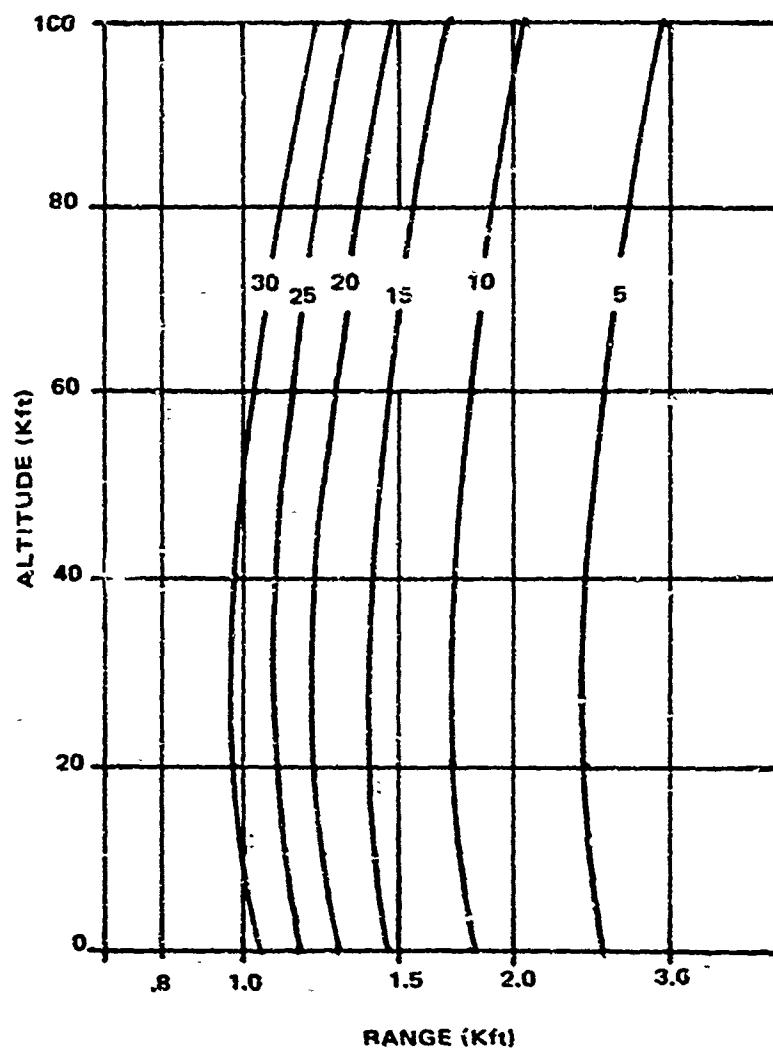


Figure 2-14. -- Thermal flux density (cal./cm.²) as a function of altitude and range.

SECTION 3

CONCLUSIONS

- 3-1. It is found that overpressure, density, and Rho-U decrease with increasing altitude; particle velocity, pressure ratio, shock strength, and density ratio increase with increasing altitude; thermal flux density and dynamic pressure remain relatively unchanged with increasing altitude.
- 3-2. This type of presentation should be very useful in determining approximate sure-kill and/or sure-survival ranges for the various aerodynamic vehicles. By placing the various isovales on a single chart, a sure-kill envelope could be drawn for the range 0 to 100,000 feet. For example, if the sure-kill criteria is an overpressure of 2 p.s.i., a particle velocity of 100 ft./sec., or a thermal flux density of 20 cal./cm.², and a sure-survival criteria is an overpressure of 1 p.s.i., a particle velocity of 50 ft./sec., or a thermal flux density of 10 cal./cm.², then the determining sure-kill/sure-survival range for a 1-kt. explosion is entirely dependent on the particle velocity, as shown in figure 3-1.

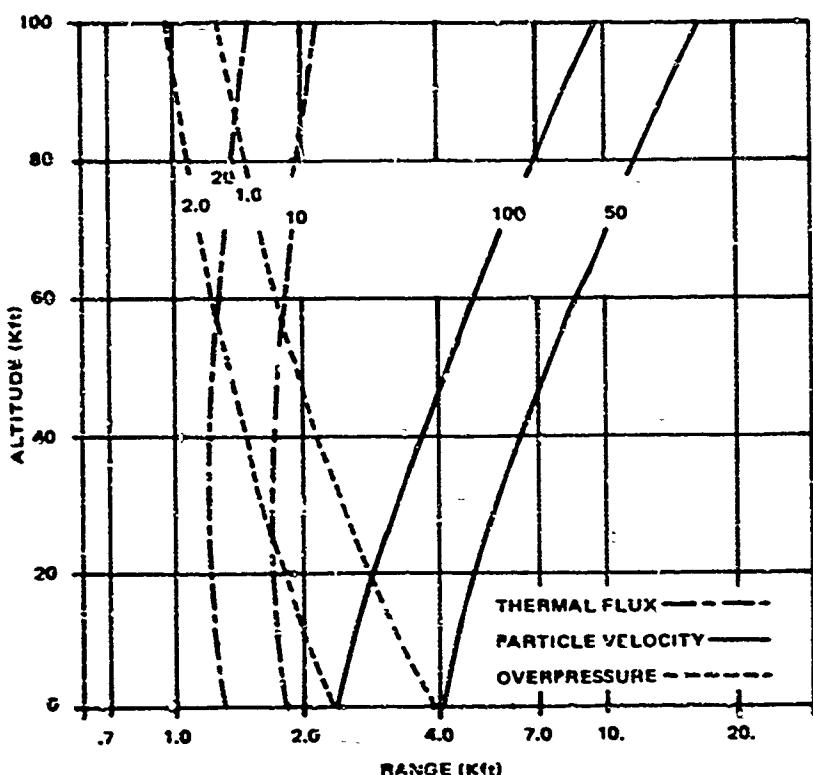


Figure 3-1. -- Free-field overpressure (p. s. i.), thermal flux density (cal./cm.²), and particle velocity (ft./sec.) for 1 kt.

SECTION 4

BIBLIOGRAPHY

1. "Nuclear Weapons Blast Phenomena." US59 (DASA 1200), March 1960.
2. "Long Range Propagation of Spherical Shockwaves from Explosions in Air." NOLTR 69-88, 22 July 1969.
3. Effects manual, "Capabilities of Nuclear Weapons." 1 January 1968.
4. "Thermal Radiation Phenomena." KN-68-504(R), Chapter 3, 26 May 1969.
5. "The ARDC Model Atmosphere." Air Force Surveys in Geophysics No. 115 (AFCRC-TR-59-267), 1959.

APPENDIX I

INTERPOLATION SCHEME

The interpolation scheme used is a straight-line approximation scheme; i.e., it is assumed that in a well-behaved region of a curve, two points can be chosen, and the straight line defined by these points can be used to generate a value of R that will approach the desired value of R . By repeated use of this scheme, the desired value of R can be approached to within any desired accuracy. The program actually used an accuracy of 0.1 percent in R .

An initial value of R_1 is chosen, and then R_2 is chosen to be equal to $2R_1$. The scheme is as follows:

$$\text{slope} = \frac{f(R_1) - f(R_2)}{R_1 - R_2}$$

$$\text{obviously, slope} = \frac{f(R_1) - f(R_{\text{desired}})}{R_1 - R_{\text{new}}}$$

$$\text{therefore, } R_{\text{new}} = \frac{R_1 + f(R_{\text{desired}}) - f(R_1)}{\text{slope}}$$

If $|R_{\text{new}} - R_1| \leq 0.001R_1$, then R_{new} is indeed R_{desired} . If $|R_{\text{new}} - R_1| > 0.001R_1$, then

$$R_1 \approx R_2$$

$$R_2 = R_{\text{new}}$$

and another value of R is generated until the condition of $|R_{\text{new}} - R_1| \leq 0.001R_1$ is met.

This method of interpolation is valid as long as the following conditions are met:

- (1) $f(R_1) = f(R_2)$ for $R_1 = R_2$
- (2) $f(R)$ is continuous over the specified range
- (3) $f'(R)$ is continuous over the specified range.

Obviously, the closer $f(R)$ is to a straight line, the faster this scheme will work. For this reason, since the base curve overpressure plot, which is the main curve for calculating most of our quantities, has a dependence on R similar to $R^{-\text{exponent}}$, and $Q \propto R^{-2}$, a log-log plot was used; that is, instead of slope $\frac{f(R_1) - f(R_2)}{R_1 - R_2}$, the formula slope =

$$\frac{\log f(R_1) - \log f(R_2)}{\log R_1 - \log R_2} \text{ was used.}$$

The use of this latter formula is more than just a convenience, it is a necessity when R approaches 0. At this point ($R = 0$), the necessary conditions that $f(R)$ and $f'(R)$ be continuous no

longer hold. By "flattening" the curve with the use of $\log f(R)$, the discontinuity at $R = 0$ can be much more closely approached.

APPENDIX II
FORTRAN PROGRAMS AND PRINTOUTS

A. SUBROUTINE RP 1271

```

SUBROUTINE RP1271(NM,PNT)
C
C SUBROUTINE FOR IKT/SL BASE CURVE. RETURNS QVS(PRESSURE(PST)) WHEN
C GIVEN RANGE NM(NM).
C SOURCES OF DATA--ABOVE 60 PSI: USGS. BELOW 60: WOLTR 69-88.
DIMENSION RL2743,RL2743
DATA NLIST/74/
DATA RL2743/19020,.022821,0.00867,0.00048,-0.00104,0.00572,-0.00558,
1.00000,.00858+0.07620+.06302-.09132+.09906+.10640,
1.1442+0.0205,-0.0044,-0.0046,-0.0024,
2.186,-0.170,-0.223,-0.243,-0.265,-0.284,-0.317,-0.324,-0.370,-0.421,
1.00002,-0.0071,-0.0020,-0.0024,-0.0034,-0.0034,-0.0034,-0.0034,-0.0034,-0.0034,
4.109,-1.18,-1.255,-1.35,-1.52,-1.68,-1.83,-2.18,-2.51,-3.17,
5.382,-6.82,-7.14,-7.79,-8.44,-9.24,-11.83,-12.33,-14.34,
617.55,-20.2,-22.8,-25.4,-28.7,-30.5,-41.7,-57.4,-78.2,-120.0,
7.193,-11.8,-12.4,-13.6,-14.5,-15.4,-16.4,-17.4,-18.4,-19.4,
DATA P/17200.,8000.,4240.,2490.,1860.,900.,545.,360.,
1.234,-184,-184,-182,-182,-182,-182,-182,-182,-182,
1.50,-0.0246,-0.07,-0.22,-0.29,-0.39,-0.53,-0.71,-0.93,-
219.38437,-28.411,-34.411,-34.9,-743.8,-474,-446.4,-0.534,-3.426,-4.842,
34.074+3.933+3.105+2.769+2.481+2.065+1.899+1.706+1.390+1.235,
A1.116.1,-0.07,-0.22,-0.46,-0.63,-0.82,-0.98,-1.12,-1.27,-
5.2326+1.927+0.1643+0.1626+0.1525+0.0926+0.0784+0.0679+0.0598+0.0481,
0.0002154+0.03388+0.02518+0.01888+0.01334+0.01374+0.00284+0.00481,
7.002890+0.001684+7.337+0.1,0.304E-07/
C
DO 10 N=1,NLIST
10 CONTINUE
10 CONTINUE
10 TO 98
11 IF(N.EQ.1) GO TO 98
FACT=ALOG10(PI(N))-ALOG10(PI(N-1))+ALOG10(PI(N-2))-ALOG10(PI(N-3))
PSILOG=4*LOG10(P(N-1))-FACT+(ALOG10(P(N))-ALOG10(P(N-1)))
PIALO=EXP(PSILOG)
RETURN
98 PILOD.
RETURN
END.

```

01/19/79 A105.PN ASRAB.S 11073 COMPILER
 0 MIN 0 SEC FOR COMPILE PASS
 38 CARDS AT 233 CARDS PER MINUTE
 1922 DIGITS DATA, 1278 DIGITS CODE.

B. SUBROUTINE ARDC

SUB-DUINE ARDCAL17C.DRATIO.TRATIO.DRATIO
 REVERSE C
 H.A. KINZLER, R.S., CHAMPION, AND M.L. POND. THE ARDC MODEL C
 ATMOSPHERE, 1957-1973. AIR FORCE SURVEYS IN GEOPHYSICS VOL 213 C
 (AFCHC-TR-59-207), AIR FORCE CAMBRIDGE RES. CENTER, AUG 1973. C
 ALTITUDE/ALTITUDE IN CENTIMETERS C
 PARTITIONATIO OF AMBIENT PRESSURE TO SEA LEVEL PRESSURE (1 ATN), C
 PARTITIONATIO OF AMBIENT TEMPERATURE TO SEA-LEVEL TEMP (288.16 K), C
 DRATIO/RATIO OF AMBIENT DENSITY TO SEA LEVEL DENSITY (.001229 G/CC) C
 100 ALT2=ALT1/100.
 ALT0=1356766.0*ALT1/(8356766.0+ALT2)
 IF(ALT1.GT.15000.) GO TO 102
 101 TEMP0=78.16+0.0003*ALT1
 PAW0=1.498173/(288.160+0.0003*ALT1)+0.25612210
 GO TO 118
 102 IF(ALT1.GT.25000.) GO TO 104
 103 TEMP=218.66
 PAW0=1.28254520/(10.0*(0.068883257*(0.3*(ALT1-11000.0))))
 GO TO 118
 104 IF(ALT1.GT.47000.) GO TO 106
 105 TEMP=218.66+0.0003*(ALT1-25000.0)
 PAW0=0.38094654/(1.1*(1.660+3.0E-3*ALT1)/218.66))+0.1539825473
 GO TO 118
 106 IF(ALT1.GT.53000.) GO TO 108
 107 TEMP=202.66
 PAW0=0.01745887/(10.0*(0.0524872682)*(0.3*(ALT1-47000.0)))
 GO TO 118
 108 IF(ALT1.GT.70000.) GO TO 110
 109 TEMP=242.66+0.0003*(ALT1-53000.0)
 PAW0=0.404008/-3/(202.66/TEMP)+0.75921761
 GO TO 118
 110 IF(ALT1.GT.90000.) GO TO 112
 111 TEMP=105.66
 PAW0=1.461987-4-EXP(-0.0381647982*(ALT1-70000.0))/165.66 F
 GO TO 118
 112 IF(ALT1.GT.105000.) GO TO 114
 113 TEMP=145.66+0.0004*(ALT1-90000.0)
 PAW0=1.55174557*(185.887/TEMP)+0.851188
 GO TO 118
 114 IF(ALT1.GT.160000.) GO TO 116
 115 TEMP=225.63+0.0002*(ALT1-105000.0)
 PAW0=1.744821*(621225.63/TEMP)+0.789238
 GO TO 118
 116 IF(ALT1.GT.170000.) GO TO 119
 117 TEMP=1325.4660+0.0003*(ALT1-160000.0)
 PAW0=1.14015E-9+(1325.466/TEMP)+0.34164790
 GO TO 118
 119 IF(ALT1.GT.230000.) GO TO 121
 120 TEMP=125.63+0.0005*(ALT1-170000.0)
 PAW0=0.6354E-8+(125.63/TEMP)+0.832958
 GO TO 118
 121 TEMP=157.66+0.00035*(ALT1-200000.0)
 PAW0=2.0531E-8+(157.66/TEMP)+0.751369
 122 TRATIO=TEMP/386.16
 PARTITIONRATIO=PAW0/386.16
 DENSITY=3.2365427E-8*PAW0/TEMP
 DRATIO=15.34758178
 DENSITY IS IN UNITS OF SLUGS PER SQUARE INCH PER FOOT,
 DRATIO=15.34758178
 RETURN
 END

4. PEAK OVERPRESSURE PROGRAM

D. PEAK OVERPRESSURE PRINTOUT

E. DYNAMIC PRESSURE PROGRAM

```

      FILE 50H005EX UNIT = READER
      01M44400N 0004H0227 0VAL1227
      1 READ(5,2) N,COST,R,IN,IVAL
      2 FORMAT(3I1,I3,I2,I2)
      READ(5,3) (M08KH(I),I=1,IN)
      3 FORMAT(1E10.9)
      READ(5,3) (VAL(I),I=1,IVAL)
      CALL CLEASC(3)*4*PP
      WRITE(6,4)
      4 FORMAT(35H   N      COST      RPM )
      WRITE(6,5) N,COST,R
      5 FORMAT(1E10.9)
      WRITE(6,6)
      6 IN
      DO 50 I=1,IVAL
      WRITE(6,7) I,VAL(I)
      7 FORMAT(1E10.3)
      WRITE(6,8)
      8 FORMAT(10H  ALT      N      RFT      B      QVP      BY )
      9 INP      PARVEL  DENSITY  DENSITY  RHOU  OTHER
      OTHER=0,
      RHOIN
      DO 50 J=1,IN
      WRITE(6,10)
      10 LTHC=M08KH(CJ)+1.E3
      CALL ADDE(LTHC,PRATIO,TRATIO,DURATIO)
      PSIAC=PRATIO*16.696
      PRATIO=1.0125*25.08
      WRITE(6,11)
      11 THIS IS THE SCALING FACTOR FOR INP.
      SCAFAC=37*(.00/0.1643)*M08KH(J)
      IF(M08KH(J).GT.10.22)SCAFAC=37*(.23/12.19)*(M08KH(J)-10.22)
      CALL THERM(THERM,TRATE,THERM)
      IF(M08KH(J).GT.10.22)M08KH(J)=1.0*.12*(M08KH(J)-13.222)/12.222
      SPECOST=8.7258
      6 ALTHC=M08KH(J)+RCOST
      7 COST=(ALTHC*ALT)
      CALL ADDE(COST,TRATIO,TRATIO,DURATIO)
      IF(ALT,0.0) GO TO 12
      ALT=0,
      RHO=M08KH(J)/COST
      12 INP=ALT*1.E3
      CALL ADDE(LTHC,PRATIO,TRATIO,DURATIO)
      13 PFACT=(1.0/PFACT)*.33333333
      RINT=RFACT
      CALL RP127(RINT,PINT)
      CPMPINT=PFACT
      QVP=2.5*QVP*QVP/(7.0+PSIAC*B*QVP)
      PSIAC=PRATIO*16.696
      PVPAP=QVP/PSIAC
      14 SPRTDQVTP=27*PVP
      15 P100VTP
      16 INP
      R=2,0R
      RHOIN=1
      GO TO 6
      20 P200VTP
      H2IN
      RHOIN=1
      UNP1/P2
      CRHTAL(1)/PI
      ANALOG(4H)
      QVP=QVP*W
      COALOG(CN)
      ACB=ACB*W
      RHO1=EXP(ACB)
      P200
      R100
      30 P100VTP=27*P100
      RHO1=UNP1/R100
      31 P100VTP=27*P100
      RHO1=UNP1/R100
      32 RINT=0.23
      33 F100VTP=27*P100
      GO TO 50
      34 P100VTP=27*P100
      RHO1=UNP1/R100
      35 P100VTP=27*P100
      RHO1=UNP1/R100
      36 RINT=0.23
      37 F100VTP=27*P100
      RHO1=UNP1/R100
      38 RINT=0.23
      39 F100VTP=27*P100
      RHO1=UNP1/R100
      40 RINT=0.23
      41 F100VTP=27*P100
      RHO1=UNP1/R100
      42 RINT=0.23
      43 F100VTP=27*P100
      RHO1=UNP1/R100
      44 RINT=0.23
      45 F100VTP=27*P100
      RHO1=UNP1/R100
      46 RINT=0.23
      47 F100VTP=27*P100
      RHO1=UNP1/R100
      48 RINT=0.23
      49 F100VTP=27*P100
      RHO1=UNP1/R100
      50 CONTINUE
      51 STOP
      END
      END

      01/20/72 1113 PR 35H005 1072 COMPILER
      0-11-30-322 FOR COMPILEATION-PASS
      92 CARDS AT 100 CARDS PER MINUTE
      1030-010173-DATR 1900-020173-COOP.

```

F. DYNAMIC PRESSURE PRINTOUT

G. PARTICLE VELOCITY PRINTOUT

		CUST.		WIND			
		.100E+01		.000E+00		.200E-00	
VAL= .230E+02							
ALY	N	WRF	0	DVF	WVF	PARVEL	DFNSIV
.000E+00	.100E+01	.700E+01	.633E+00	.467E+00	.324E+02	.253E+02	.782E+01
.001E+01	.100E+01	.777E+01	.595E+00	.333E+00	.378E+02	.250E+02	.778E+01
.002E+01	.100E+01	.854E+01	.594E+00	.232E+00	.253E+02	.253E+02	.618E+01
.003E+01	.100E+01	.930E+01	.585E+00	.156E+00	.198E+02	.250E+02	.738E+01
.004E+01	.100E+01	.997E+01	.585E+00	.120E+00	.131E+02	.250E+02	.685E+01
.005E+01	.100E+01	.111E+02	.261E+00	.120E+00	.131E+02	.250E+02	.502E+01
.006E+01	.100E+01	.123E+02	.183E+00	.623E+00	.814E+02	.123E+02	.302E+00
.007E+01	.100E+01	.135E+02	.130E+00	.389E+01	.508E+02	.753E+02	.100E+00
.008E+01	.100E+01	.147E+02	.107E+00	.240E+01	.314E+02	.250E+02	.65E+00
.009E+01	.100E+01	.160E+02	.895E+00	.977E+01	.150E+03	.198E+02	.250E+02
.010E+01	.100E+01	.173E+02	.718E+00	.118E+03	.250E+02	.178E+02	.100E+01
.011E+01	.100E+01	.186E+02	.549E+00	.346E+02	.713E+02	.250E+02	.265E+01
.012E+01	.100E+01	.200E+02	.377E+00	.713E+02	.150E+03	.103E+01	.250E+02
.013E+01	.100E+01	.213E+02	.203E+00	.118E+03	.250E+02	.103E+01	.100E+01
.014E+01	.100E+01	.226E+02	.125E+00	.346E+02	.713E+02	.250E+02	.65E+01
.015E+01	.100E+01	.239E+02	.470E+00	.113E+03	.150E+03	.103E+01	.250E+02
.016E+01	.100E+01	.252E+02	.317E+00	.313E+03	.508E+02	.618E+01	.250E+02
.017E+01	.100E+01	.265E+02	.238E+00	.937E+02	.305E+02	.103E+01	.000E+00
.018E+01	.100E+01	.278E+02	.158E+00	.231E+00	.127E+03	.105E+01	.300E+02
.019E+01	.100E+01	.291E+02	.791E+00	.421E+00	.791E+02	.500E+02	.773E+02
.020E+01	.100E+01	.304E+02	.000E+00	.127E+00	.421E+02	.500E+02	.100E+00
.021E+01	.100E+01	.317E+02	.337E+00	.288E+00	.127E+02	.500E+02	.238E+00
.022E+01	.100E+01	.330E+02	.227E+00	.120E+00	.804E+02	.500E+02	.149E+00
.023E+01	.100E+01	.343E+02	.127E+00	.482E+00	.500E+02	.105E+01	.300E+02
.024E+01	.100E+01	.356E+02	.217E+00	.227E+00	.127E+02	.500E+02	.105E+01
.025E+01	.100E+01	.369E+02	.127E+00	.482E+00	.500E+02	.105E+01	.300E+02
.026E+01	.100E+01	.382E+02	.161E+00	.113E+01	.293E+03	.300E+02	.105E+01
.027E+01	.100E+01	.395E+02	.177E+00	.184E+01	.482E+02	.127E+02	.105E+01
.028E+01	.100E+01	.408E+02	.191E+00	.240E+01	.500E+02	.105E+01	.300E+02
.029E+01	.100E+01	.421E+02	.205E+00	.293E+01	.500E+02	.105E+01	.300E+02
.030E+01	.100E+01	.434E+02	.217E+00	.346E+01	.500E+02	.105E+01	.300E+02
.031E+01	.100E+01	.447E+02	.229E+00	.399E+01	.500E+02	.105E+01	.300E+02
.032E+01	.100E+01	.460E+02	.242E+00	.452E+01	.500E+02	.105E+01	.300E+02
.033E+01	.100E+01	.473E+02	.255E+00	.505E+01	.500E+02	.105E+01	.300E+02
.034E+01	.100E+01	.486E+02	.268E+00	.558E+01	.500E+02	.105E+01	.300E+02
.035E+01	.100E+01	.500E+02	.281E+00	.611E+01	.500E+02	.105E+01	.300E+02
.036E+01	.100E+01	.513E+02	.294E+00	.664E+01	.500E+02	.105E+01	.300E+02
.037E+01	.100E+01	.526E+02	.307E+00	.717E+01	.500E+02	.105E+01	.300E+02
.038E+01	.100E+01	.539E+02	.320E+00	.770E+01	.500E+02	.105E+01	.300E+02
.039E+01	.100E+01	.552E+02	.333E+00	.823E+01	.500E+02	.105E+01	.300E+02
.040E+01	.100E+01	.565E+02	.346E+00	.876E+01	.500E+02	.105E+01	.300E+02
.041E+01	.100E+01	.578E+02	.359E+00	.929E+01	.500E+02	.105E+01	.300E+02
.042E+01	.100E+01	.591E+02	.372E+00	.982E+01	.500E+02	.105E+01	.300E+02
.043E+01	.100E+01	.604E+02	.385E+00	.1035E+02	.500E+02	.105E+01	.300E+02
.044E+01	.100E+01	.617E+02	.400E+00	.1088E+02	.500E+02	.105E+01	.300E+02
.045E+01	.100E+01	.630E+02	.413E+00	.1141E+02	.500E+02	.105E+01	.300E+02
.046E+01	.100E+01	.643E+02	.426E+00	.1194E+02	.500E+02	.105E+01	.300E+02
.047E+01	.100E+01	.656E+02	.439E+00	.1247E+02	.500E+02	.105E+01	.300E+02
.048E+01	.100E+01	.669E+02	.452E+00	.1300E+02	.500E+02	.105E+01	.300E+02
.049E+01	.100E+01	.682E+02	.465E+00	.1353E+02	.500E+02	.105E+01	.300E+02
.050E+01	.100E+01	.695E+02	.478E+00	.1406E+02	.500E+02	.105E+01	.300E+02
.051E+01	.100E+01	.708E+02	.491E+00	.1459E+02	.500E+02	.105E+01	.300E+02
.052E+01	.100E+01	.721E+02	.504E+00	.1512E+02	.500E+02	.105E+01	.300E+02
.053E+01	.100E+01	.734E+02	.517E+00	.1565E+02	.500E+02	.105E+01	.300E+02
.054E+01	.100E+01	.747E+02	.530E+00	.1618E+02	.500E+02	.105E+01	.300E+02
.055E+01	.100E+01	.760E+02	.543E+00	.1671E+02	.500E+02	.105E+01	.300E+02
.056E+01	.100E+01	.773E+02	.556E+00	.1724E+02	.500E+02	.105E+01	.300E+02
.057E+01	.100E+01	.786E+02	.569E+00	.1777E+02	.500E+02	.105E+01	.300E+02
.058E+01	.100E+01	.800E+02	.582E+00	.1830E+02	.500E+02	.105E+01	.300E+02
.059E+01	.100E+01	.813E+02	.595E+00	.1883E+02	.500E+02	.105E+01	.300E+02
.060E+01	.100E+01	.826E+02	.608E+00	.1936E+02	.500E+02	.105E+01	.300E+02
.061E+01	.100E+01	.839E+02	.621E+00	.1989E+02	.500E+02	.105E+01	.300E+02
.062E+01	.100E+01	.852E+02	.634E+00	.2042E+02	.500E+02	.105E+01	.300E+02
.063E+01	.100E+01	.865E+02	.647E+00	.2095E+02	.500E+02	.105E+01	.300E+02
.064E+01	.100E+01	.878E+02	.660E+00	.2148E+02	.500E+02	.105E+01	.300E+02
.065E+01	.100E+01	.891E+02	.673E+00	.2191E+02	.500E+02	.105E+01	.300E+02
.066E+01	.100E+01	.904E+02	.686E+00	.2244E+02	.500E+02	.105E+01	.300E+02
.067E+01	.100E+01	.917E+02	.699E+00	.2297E+02	.500E+02	.105E+01	.300E+02
.068E+01	.100E+01	.930E+02	.712E+00	.2350E+02	.500E+02	.105E+01	.300E+02
.069E+01	.100E+01	.943E+02	.725E+00	.2393E+02	.500E+02	.105E+01	.300E+02
.070E+01	.100E+01	.956E+02	.738E+00	.2446E+02	.500E+02	.105E+01	.300E+02
.071E+01	.100E+01	.969E+02	.751E+00	.2499E+02	.500E+02	.105E+01	.300E+02
.072E+01	.100E+01	.982E+02	.764E+00	.2552E+02	.500E+02	.105E+01	.300E+02
.073E+01	.100E+01	.995E+02	.777E+00	.2605E+02	.500E+02	.105E+01	.300E+02
.074E+01	.100E+01	.1008E+02	.790E+00	.2658E+02	.500E+02	.105E+01	.300E+02
.075E+01	.100E+01	.1021E+02	.803E+00	.2711E+02	.500E+02	.105E+01	.300E+02
.076E+01	.100E+01	.1034E+02	.816E+00	.2764E+02	.500E+02	.105E+01	.300E+02
.077E+01	.100E+01	.1047E+02	.829E+00	.2817E+02	.500E+02	.105E+01	.300E+02
.078E+01	.100E+01	.1060E+02	.842E+00	.2870E+02	.500E+02	.105E+01	.300E+02
.079E+01	.100E+01	.1073E+02	.855E+00	.2923E+02	.500E+02	.105E+01	.300E+02
.080E+01	.100E+01	.1086E+02	.868E+00	.2976E+02	.500E+02	.105E+01	.300E+02
.081E+01	.100E+01	.1100E+02	.881E+00	.3029E+02	.500E+02	.105E+01	.300E+02
.082E+01	.100E+01	.1113E+02	.894E+00	.3082E+02	.500E+02	.105E+01	.300E+02
.083E+01	.100E+01	.1126E+02	.907E+00	.3135E+02	.500E+02	.105E+01	.300E+02
.084E+01	.100E+01	.1139E+02	.920E+00	.3188E+02	.500E+02	.105E+01	.300E+02
.085E+01	.100E+01	.1152E+02	.933E+00	.3241E+02	.500E+02	.105E+01	.300E+02
.086E+01	.100E+01	.1165E+02	.946E+00	.3294E+02	.500E+02	.105E+01	.300E+02
.087E+01	.100E+01	.1178E+02	.959E+00	.3347E+02	.500E+02	.105E+01	.300E+02
.088E+01	.100E+01	.1191E+02	.972E+00	.3399E+02	.500E+02	.105E+01	.300E+02
.089E+01	.100E+01	.1204E+02	.985E+00	.3452E+02	.500E+02	.105E+01	.300E+02
.090E+01	.100E+01	.1217E+02	.998E+00	.3495E+02	.500E+02	.105E+01	.300E+02
.091E+01	.100E+01	.1230E+02	.1011E+00	.3548E+02	.500E+02	.105E+01	.300E+02
.092E+01	.100E+01	.1243E+02	.1024E+00	.3591E+02	.500E+02	.105E+01	.300E+02
.093E+01	.100E+01	.1256E+02	.1037E+00	.3644E+02	.500E+02	.105E+01	.300E+02
.094E+01	.100E+01	.1269E+02	.1050E+00	.3697E+02	.500E+02	.105E+01	.300E+02
.095E+01	.100E+01	.1282E+02	.1063E+00	.3750E+02	.500E+02	.105E+01	.300E+02
.096E+01	.100E+01	.1295E+02	.1076E+00	.3793E+02	.500E+02	.105E+01	.300E+02
.097E+01	.100E+01	.1308E+02	.1089E+00	.3846E+02	.500E+02	.105E+01	.300E+02
.098E+01	.100E+01	.1321E+02	.1102E+00	.3899E+02	.500E+02	.105E+01	.300E+02
.099E+01	.100E+01	.1334E+02	.1115E+00	.3952E+02	.500E+02	.105E+01	.300E+02
.100E+01	.100E+01	.1347E+02	.1128E+00	.4005E+02	.500E+02	.105E+01	.300E+02
.101E+01	.100E+01	.1360E+02	.1141E+00	.4058E+02	.500E+02	.105E+01	.300E+02
.102E+01	.100E+01	.1373E					

H. DENSITY RATIO PRINTOUT

	COST	RHIC	VAL = .100E+01	RKFT	0	DVF	DVRF	DVNP	DAPVEL	DFNSTY	DFNSAT	RHOU	OT-ER
	.100F+01	.000F+00	.200E+00										
SLT	"	"	"										
.000E+00	.100F+01	.151E+01	.150F+02	.429E+01	.430E+00	.200E+03	.918E+01	.120F+01	.191E+02	.120E+01	.120E+01		
.305E+01	.100F+01	.139E+01	.121E+02	.293E+01	.293E+00	.200E+03	.874E+01	.120F+01	.136E+02	.120E+01	.120E+01		
.610E+01	.100F+01	.102E+01	.102E+02	.887E+01	.107E+01	.107E+00	.103E+03	.488E+01	.120E+01	.948E+01	.120E+01	.120E+01	
.915E+01	.100E+01	.211E+01	.211E+02	.638E+01	.128E+01	.128E+00	.105E+03	.344E+01	.120E+01	.638E+01	.120E+01	.120E+01	
.122E+02	.100E+01	.246E+01	.246E+02	.790E+01	.790E+01	.100E+00	.100E+03	.227E+01	.120E+01	.409E+01	.120E+01	.120E+01	
.152E+02	.100E+01	.268E+01	.268E+02	.367E+01	.367E+00	.349E+01	.180E+03	.141E+01	.120E+01	.255E+01	.120E+01	.120E+01	
.182E+02	.100E+01	.330E+01	.330E+02	.309E+01	.309E+00	.309E+01	.180E+03	.681E+02	.120E+01	.159E+01	.120E+01	.120E+01	
.212E+02	.970E+00	.373E+01	.229E+02	.191E+01	.191E+00	.191E+01	.180E+03	.544E+02	.120E+01	.980E+00	.120E+01	.120E+01	
.243E+02	.940E+00	.454E+01	.180E+01	.119E+00	.119E+00	.119E+01	.180E+03	.340E+02	.120E+01	.613E+00	.120E+01	.120E+01	
.273E+02	.910E+00	.527E+01	.148E+01	.739E+01	.739E+00	.739E+01	.200E+02	.123E+01	.344E+00	.120E+01	.344E+00	.120E+01	
.303E+02	.880E+00	.580E+01	.116E+01	.668E+01	.668E+00	.180E+03	.124E+01	.120E+01	.232E+00	.120E+01	.232E+00	.120E+01	
VAL = .150E+01	RKFT	0	DVF	DVRF	DVNP	DAPVEL	DFNSTY	DFNSAT	RHOU	OT-ER			
	.100F+01	.793E+00	.501E+02	.114E+02	.285E+01	.480E+03	.112E+00	.150E+01	.550E+02	.120E+01			
.305E+01	.100E+01	.791E+00	.378E+02	.785E+01	.114E+01	.863E+03	.847E+01	.150E+01	.392E+02	.120E+01			
.610E+01	.100F+01	.103E+01	.277E+02	.292E+01	.131E+01	.446E+03	.617E+01	.150E+01	.773E+02	.120E+01			
.915E+01	.100E+01	.119E+01	.119E+02	.389E+01	.380E+01	.386E+00	.477E+03	.430E+01	.150E+01	.168E+02	.120E+01		
.122E+02	.100E+01	.139E+01	.151E+02	.212E+01	.529E+01	.414E+03	.283E+01	.150E+01	.119E+02	.120E+01			
.152E+02	.100E+01	.191E+01	.868E+01	.923E+00	.205E+00	.410E+03	.114E+01	.150E+01	.450E+01	.150E+01			
.182E+02	.100E+01	.222E+01	.700E+01	.508E+00	.127E+00	.473E+03	.876E+02	.180E+01	.282E+01	.150E+01			
.212E+02	.940E+00	.257E+01	.118E+01	.793E+00	.118E+00	.425E+02	.150E+01	.177E+01	.150E+01	.150E+01			
.243E+02	.910E+00	.291E+01	.850E+01	.167E+00	.891E+01	.472E+03	.255E+02	.150E+01	.108E+01	.150E+01	.150E+01		
.273E+02	.880E+00	.334E+01	.363E+01	.124E+00	.311E+01	.431E+03	.155E+02	.150E+01	.668E+00	.150E+01			
VAL = .180E+01	RKFT	0	DVF	DVRF	DVNP	DAPVEL	DFNSTY	DFNSAT	RHOU	OT-ER			
	.100F+01	.793E+00	.501E+02	.114E+02	.285E+01	.480E+03	.112E+00	.150E+01	.550E+02	.120E+01			
.305E+01	.100E+01	.791E+00	.378E+02	.785E+01	.114E+01	.863E+03	.847E+01	.150E+01	.392E+02	.120E+01			
.610E+01	.100F+01	.778E+01	.408E+02	.902E+01	.361E+01	.675E+01	.732E+01	.180E+01	.498E+02	.120E+01			
.915E+01	.100E+01	.299E+00	.350E+02	.208E+01	.233E+01	.588E+03	.310E+01	.180E+01	.334E+02	.120E+01			
.122E+02	.100E+01	.102E+01	.246E+02	.365E+01	.146E+01	.430E+03	.341E+01	.180E+01	.215E+02	.120E+01			
.152E+02	.100E+01	.123E+01	.201E+02	.227E+01	.910E+00	.633E+03	.212E+01	.180E+01	.134E+02	.120E+01			
.182E+02	.100E+01	.144E+01	.152E+02	.142E+01	.567E+00	.630E+03	.132E+01	.180E+01	.833E+01	.120E+01			
.212E+02	.970E+00	.158E+01	.123E+02	.873E+00	.350E+00	.633E+03	.181E+02	.180E+01	.514E+01	.120E+01			
.243E+02	.940E+00	.184E+01	.989E+01	.244E+00	.219E+00	.630E+03	.514E+02	.180E+01	.321E+01	.120E+01			
.273E+02	.910E+00	.222E+01	.179E+01	.338E+00	.139E+00	.630E+03	.306E+02	.180E+01	.188E+01	.120E+01			
.303E+02	.880E+00	.250E+01	.638E+01	.214E+00	.657E+01	.633E+03	.181E+02	.180E+01	.122E+01	.120E+01			
VAL = .200E+01	RKFT	0	DVF	DVRF	DVNP	DAPVEL	DFNSTY	DFNSAT	RHOU	OT-ER			
	.100F+01	.527E+00	.114E+03	.257E+02	.129E+01	.882E+03	.154E+01	.200E+01	.157E+03	.200E+01			
.305E+01	.100E+01	.397E+00	.650E+02	.177E+02	.464E+01	.651E+03	.113E+01	.200E+01	.714E+02	.200E+01			
.610E+01	.100F+01	.631E+01	.114E+02	.591E+01	.819E+01	.819E+01	.819E+01	.200E+01	.668E+02	.200E+01			
.915E+01	.100E+01	.787E+00	.353E+02	.765E+01	.765E+01	.786E+03	.786E+01	.200E+01	.451E+02	.200E+01			
.122E+02	.100E+01	.102E+01	.246E+02	.345E+02	.470E+01	.239E+01	.765E+03	.374E+01	.200E+01	.289E+02	.200E+01		
.152E+02	.100E+01	.123E+01	.201E+02	.227E+01	.1149E+01	.765E+03	.236E+01	.200E+01	.180E+02	.200E+01			
.182E+02	.100E+01	.144E+01	.198E+02	.195E+02	.927E+00	.765E+03	.164E+01	.200E+01	.112E+02	.200E+01			
.212E+02	.970E+00	.147E+01	.157E+02	.114E+01	.572E+00	.765E+03	.906E+01	.200E+01	.693E+01	.200E+01			
.243E+02	.940E+00	.177E+01	.120E+02	.716E+00	.358E+00	.765E+03	.164E+02	.200E+01	.433E+01	.200E+01			
.273E+02	.910E+00	.213E+01	.163E+02	.443E+00	.222E+00	.777E+03	.340E+02	.200E+01	.264E+01	.200E+01			
.303E+02	.880E+00	.222E+01	.828E+01	.240E+00	.703E+01	.201E+02	.220E+01	.200E+01	.184E+01	.200E+01			
VAL = .230E+01	RKFT	0	DVF	DVRF	DVNP	DAPVEL	DFNSTY	DFNSAT	RHOU	OT-ER			
	.100F+01	.444E+00	.157E+03	.362E+02	.235E+02	.121E+03	.176E+00	.233E+01	.199E+03	.230E+01			
.305E+01	.100E+01	.307E+00	.114E+03	.729E+02	.162E+02	.107E+04	.130E+01	.233E+01	.137E+03	.230E+01			
.610E+01	.100F+01	.554E+00	.106E+02	.166E+02	.106E+02	.103E+04	.819E+01	.233E+01	.668E+02	.230E+01			
.915E+01	.100E+01	.673E+00	.323E+02	.104E+02	.659E+01	.991E+03	.657E+01	.233E+01	.453E+02	.230E+01			
.122E+02	.100E+01	.780E+00	.474E+02	.472E+01	.437E+01	.944E+03	.435E+01	.233E+01	.419E+02	.230E+01			
.152E+02	.100E+01	.922E+00	.357E+02	.114E+01	.277E+01	.944E+03	.227E+01	.233E+01	.761E+02	.230E+01			
.182E+02	.100E+01	.109E+01	.272E+02	.261E+01	.169E+01	.944E+03	.169E+01	.233E+01	.163E+02	.230E+01			
.212E+02	.970E+00	.126E+01	.151E+02	.105E+01	.584E+01	.944E+03	.104E+01	.233E+01	.730E+01	.230E+01			
.243E+02	.940E+00	.144E+01	.101E+02	.654E+00	.654E+03	.944E+03	.65E+01	.233E+01	.420E+01	.230E+01			
.273E+02	.910E+00	.171E+01	.141E+02	.141E+02	.405E+00	.840E+03	.301E+01	.233E+01	.323E+01	.230E+01			
.303E+02	.880E+00	.194E+01	.114E+02	.394E+00	.256E+00	.944E+03	.238E+01	.233E+01	.230E+01	.230E+01			
VAL = .250E+01	RKFT	0	DVF	DVRF	DVNP	DAPVEL	DFNSTY	DFNSAT	RHOU	OT-ER			
	.100F+01	.411E+00	.180E+03	.441E+02	.331E+02	.177E+04	.177E+00	.233E+01	.250E+03	.250E+01			
.305E+01	.100E+01	.256E+00	.161E+03	.730E+02	.227E+02	.192E+04	.161E+01	.233E+01	.256E+03	.250E+01			
.610E+01	.100F+01	.533E+00	.105E+03	.203E+02	.152E+02	.115E+04	.102E+01	.233E+01	.250E+03	.250E+01			
.915E+01	.100E+01	.618E+00	.748E+02	.131E+02	.934E+01	.934E+04	.79E+01	.233E+01	.408E+01	.250E+01			
.122E+02	.100E+01	.770E+00	.547E+02	.619E+01	.614E+01	.110E+04	.673E+01	.233E+01	.253E+01	.250E+01			
.152E+02	.100E+01	.915E+00	.430E+02	.311E+01	.311E+01	.110E+04	.29E+01	.233E+01	.327E+02	.250E+01			
.182E+02	.970E+00	.1151E+01	.282E+02	.196E+01	.1147E+01	.1133E+04	.1133E+01	.233E+01	.250E+01	.250E+01			
.212E+02	.940E+00	.137E+01	.211E+02	.1123E+01	.920E+00	.1106E+04	.705E+01	.233E+01	.250E+01	.250E+01			
.243E+02	.910E+00	.1545E+01	.187E+02	.740E+00	.570E+00	.1111E+04	.624E+01	.233E+01	.374E+01	.250E+01			
.273E+02	.880E+00	.178E+01	.138E+02	.441E+00	.381E+00	.1114E+04	.230E+01	.233E+01	.294E+01	.250E+01			

I. RHO-U PRINTOUT

COST											
RHO											
.000E+01 .000E+00 .200E+00											
VAL = .500E+31											
ALT											
.000E+00	.100E+01	.243E+01	.270E+01	.314E+01	.334E+01	.319E+02	.308E+02	.296E+02	.286E+02	.270E+01	.260E+01
.305E+01	.100E+01	.304E+01	.333E+01	.313E+01	.342E+01	.367E+02	.369E+02	.350E+02	.340E+02	.300E+01	.290E+01
.610E+01	.100E+02	.269E+01	.406E+01	.107E+01	.505E+01	.117E+03	.453E+01	.111E+01	.506E+01	.506E+01	.506E+01
.914E+01	.100E+01	.303E+01	.242E+01	.372E+01	.313E+01	.313E+01	.193E+03	.333E+01	.314E+01	.301E+01	.291E+01
.122E+02	.100E+01	.213E+01	.313E+01	.392E+01	.315E+01	.213E+03	.234E+01	.122E+01	.500E+01	.500E+01	.500E+01
.152E+02	.100E+01	.190E+01	.742E+01	.520E+00	.105E+00	.311E+03	.160E+01	.134E+01	.400E+01	.500E+01	.500E+01
.182E+02	.100E+01	.133E+01	.143E+01	.565E+01	.600E+00	.238E+00	.443E+03	.111E+01	.154E+01	.449E+01	.449E+01
.213E+02	.973E+00	.176E+01	.320E+02	.452E+00	.334E+00	.619E+03	.209E+02	.178E+01	.500E+01	.500E+01	.500E+01
.243E+02	.940E+00	.160E+01	.345E+02	.416E+00	.451E+00	.037E+03	.597E+02	.211E+01	.499E+01	.499E+01	.499E+01
.274E+02	.914E+00	.131E+01	.177E+02	.739E+00	.421E+00	.113E+04	.334E+02	.255E+01	.500E+01	.500E+01	.500E+01
.305E+02	.090F+00	.144E+03	.219E+02	.807E+00	.644E+00	.154E+04	.322E+02	.309E+01	.500E+01	.500E+01	.500E+01
VAL = .100E+02											
ALT											
.000E+00	.100E+01	.204E+01	.724E+01	.231E+01	.127E+00	.114E+03	.489E+01	.111E+01	.105E+02	.300E+02	
.305E+01	.100E+01	.191E+01	.941E+01	.229E+01	.166E+00	.152E+03	.454E+01	.115E+01	.100E+02	.100E+02	
.610E+01	.100E+01	.115E+01	.947E+01	.264E+01	.216E+01	.202E+03	.494E+01	.121E+01	.956E+01	.956E+01	
.914E+01	.100E+01	.133E+01	.162E+01	.264E+02	.174E+01	.290E+00	.264E+03	.372E+01	.130E+01	.100E+02	
.122E+02	.100E+01	.150E+01	.255E+01	.177E+02	.147E+01	.378E+00	.359E+03	.271E+01	.144E+01	.100E+02	
.152E+02	.100E+01	.134E+01	.145E+01	.174E+01	.157E+01	.557E+00	.171E+03	.193E+01	.164E+01	.995E+01	
.182E+02	.100E+01	.133E+01	.179E+02	.167E+01	.767E+00	.710E+03	.141E+01	.192E+01	.100E+02	.100E+02	
.213E+02	.973E+00	.125E+01	.216E+02	.140E+01	.941E+01	.941E+03	.124E+01	.229E+01	.995E+01	.995E+01	
.243E+02	.940E+00	.111E+01	.263E+02	.166E+01	.130E+01	.130E+04	.783E+02	.277E+01	.100E+02	.100E+02	
.274E+02	.914E+00	.110E+01	.309E+02	.159E+01	.104E+01	.174E+04	.574E+02	.337E+01	.999E+01	.999E+01	
.305E+02	.090F+00	.104E+01	.308E+02	.159E+01	.104E+01	.174E+04	.574E+02	.302E+01	.100E+02	.100E+02	
VAL = -.150E+02											
ALT											
.000E+00	.100E+01	.243E+01	.110E+02	.342E+01	.273E+00	.160E+03	.084E+01	.114E+01	.150E+02	.150E+02	
.305E+01	.100E+01	.154E+01	.135E+02	.373E+01	.352E+00	.210E+03	.454E+01	.122E+01	.150E+02	.150E+02	
.610E+01	.100E+01	.133E+01	.145E+01	.340E+02	.374E+01	.457E+00	.243E+03	.533E+01	.131E+01	.150E+02	
.914E+01	.100E+01	.133E+01	.162E+01	.242E+02	.242E+01	.533E+00	.386E+03	.404E+01	.147E+01	.150E+02	
.122E+02	.100E+01	.170E+01	.216E+02	.243E+01	.798E+00	.493E+03	.303E+01	.141E+01	.150E+02	.150E+02	
.152E+02	.100E+01	.115E+01	.229E+02	.254E+01	.110E+01	.976E+03	.224E+01	.167E+01	.150E+02	.150E+02	
.182E+02	.100E+01	.112E+01	.254E+02	.247E+01	.144E+01	.917E+03	.164E+01	.223E+01	.150E+02	.150E+02	
.213E+02	.973E+00	.105E+01	.305E+02	.235E+01	.159E+01	.173E+04	.123E+01	.239E+01	.150E+02	.150E+02	
.243E+02	.940E+00	.993E+00	.379E+02	.236E+01	.252E+01	.162E+04	.626E+01	.325E+01	.150E+02	.150E+02	
.274E+02	.914E+00	.623E+00	.457E+02	.249E+01	.364E+01	.207E+04	.657E+01	.302E+01	.150E+02	.150E+02	
.305E+02	.090F+00	.888E+00	.600E+02	.245E+01	.511E+01	.375E+04	.474E+01	.295E+01	.150E+02	.150E+02	
VAL = -.200E+02											
ALT											
.000E+00	.100E+01	.133E+01	.164E+02	.447E+01	.457E+00	.216E+03	.225E+01	.121E+01	.200E+02	.200E+02	
.305E+01	.100E+01	.124E+01	.124E+02	.423E+01	.356E+00	.274E+03	.224E+01	.122E+01	.200E+02	.200E+02	
.610E+01	.100E+01	.133E+01	.145E+01	.340E+02	.365E+01	.781E+00	.353E+03	.565E+01	.130E+01	.200E+02	
.914E+01	.100E+01	.111E+01	.210E+01	.344E+01	.344E+01	.074E+00	.454E+03	.449E+01	.135E+01	.200E+02	
.122E+02	.100E+01	.100E+01	.210E+01	.251E+02	.347E+01	.130E+01	.601E+03	.233E+01	.174E+01	.200E+02	
.152E+02	.100E+01	.104E+01	.207E+01	.260E+02	.372E+01	.170E+01	.314E+03	.242E+01	.204E+01	.200E+02	
.182E+02	.100E+01	.105E+01	.209E+01	.262E+02	.373E+01	.170E+01	.315E+03	.163E+01	.224E+01	.200E+02	
.213E+02	.973E+00	.970E+00	.207E+01	.262E+02	.371E+01	.171E+01	.315E+03	.163E+01	.224E+01	.200E+02	
.243E+02	.940E+00	.627E+00	.429E+02	.311E+01	.515E+01	.242E+04	.137E+01	.302E+01	.200E+02	.200E+02	
.274E+02	.914E+00	.627E+00	.429E+02	.311E+01	.515E+01	.242E+04	.137E+01	.302E+01	.200E+02	.200E+02	
.305E+02	.090F+00	.573E+00	.429E+02	.311E+01	.515E+01	.242E+04	.137E+01	.302E+01	.200E+02	.200E+02	
VAL = -.250E+02											
ALT											
.000E+00	.100E+01	.125E+01	.210E+01	.553E+01	.705E+00	.261E+03	.050E+01	.124E+01	.250E+02	.250E+02	
.305E+01	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.753E+01	.124E+01	.250E+02	.250E+02	
.610E+01	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.753E+01	.124E+01	.250E+02	.250E+02	
.914E+01	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.753E+01	.124E+01	.250E+02	.250E+02	
.122E+02	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.753E+01	.124E+01	.250E+02	.250E+02	
.152E+02	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.753E+01	.124E+01	.250E+02	.250E+02	
.182E+02	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.753E+01	.124E+01	.250E+02	.250E+02	
.213E+02	.973E+00	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.753E+01	.124E+01	.250E+02	.250E+02	
.243E+02	.940E+00	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.753E+01	.124E+01	.250E+02	.250E+02	
.274E+02	.914E+00	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.753E+01	.124E+01	.250E+02	.250E+02	
.305E+02	.090F+00	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.753E+01	.124E+01	.250E+02	.250E+02	
VAL = -.300E+02											
ALT											
.000E+00	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.044E+01	.124E+01	.300E+02	.300E+02	
.305E+01	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.703E+01	.124E+01	.300E+02	.300E+02	
.610E+01	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.703E+01	.124E+01	.300E+02	.300E+02	
.914E+01	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.703E+01	.124E+01	.300E+02	.300E+02	
.122E+02	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.703E+01	.124E+01	.300E+02	.300E+02	
.152E+02	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.703E+01	.124E+01	.300E+02	.300E+02	
.182E+02	.100E+01	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.703E+01	.124E+01	.300E+02	.300E+02	
.213E+02	.973E+00	.104E+01	.210E+01	.553E+01	.663E+00	.334E+03	.703E+01	.124E+01	.300E+02	.300E+02	
.243E+02	.940E+00	.104E+01	.210E+01	.553E+01	.663E+00</						

J. PRESSURE RATIO PROGRAM

```

      FILE SMCDSAX, UNIT = READER
      DIMENSION LDMEM(111,111)
      1 READ(9,2) N,COST,R,I=1,IVAL
      2 FORMAT(2E10.3,2I2)
      3 READ(5,3) (NMBK(I),I=1,IBK)
      4 FORMAT(10,3)
      READ(5,4) (IVAL(I),I=1,IVAL)
      CALL FLCDF(5,2,CR)
      WRITE(6,4)
      5 FORMAT(20M     N    COST    BMH )
      WRITE(6,5) N,CUST,R
      6 FORMAT(2E10.3)
      RMBK
      RMH
      DC 50 I=1,IVAL
      WRITE(6,6) VAL(I)
      9 FORMAT(10Y0=1E10.3)
      WRITE(6,7)
      7 FORMAT(29M   ALT    N    RIFT    S    OVF    DT
      I=1,  PARVEL  DENSITY  DENSITY  BMHU  CR-ER )
      OTHERD,
      RMH
      DO 50 J=1,IM
      COUNTJ
      ALTCM=MBK(J)*1.E+5
      CALL ARDCALCM,PRATIO,TBATT,CRATI
      PSMR=PRATIO*16.696
      PRATIO=PSMR/16.696
      BMSR
      THIS IS THE SCALING FACTOR FOR INT.
      SCAFAC=.37*(.04/.144)*(MBK(J))
      IF(MBK(J).LT.12.222)SCAFAC=1.14*(.04/.144)*(MBK(J))
      IF(MBK(J).GT.10.222)SCAFAC=.37*(.13/12.19)*(MBK(J)=10.222)
      MBK(J) THE NEXT CARD IS INTERPOLATING FOR INTERNAL ENERGY.
      IF(MBK(J).GT.10.222)MBK(J)=(1.-.12*(MBK(J)=10.222)/12.222)
      IF(MBK(J).LT.12.222)
      8 ALTCM=MBK(J)*RCOST
      COST=SCAFAC*TBMATL FOR DOWNWARD.
      IF(TBMATL.GT.0.) GO TO 12
      ALTCM
      READ(MBKR(J))/COST
      12 ALTCM=ALTCM*SCAFAC
      CALL ARDCALCM,PRATIO,TBATT,CRATI
      24 PRATIO=PRATIO
      13 RFACT=(1+RFACT)*.33333333
      RFACT/RFACT
      CALL RP1271(RINT,PIKT)
      DPERP1271/PIKT
      PSIAIR=PRATIO*16.696
      PRMAM=PSIAIR/PSIAIR
      16 IF(COUNTJ) 17,17,20
      17 PRMAM=RA
      R1=R
      R2=R
      COUNTJ
      AD TO S
      20 P2=PCVFA
      R2=R

      ARDCALCM2
      BNP1/P2
      CHMAX(L11,1/P1)
      ARLOC(L11)
      READ(L11)
      COLOC(L11)
      ACBLAC(L11)
      CBL1=EXP(ACBL)
      PIKT
      R1=R2
      ISSCA=RAH/J11-.0010*M33-1A+1A+21
      21 COUNTJ=COUNTJ+1
      ITRCKUM=L203-6+8+23
      22 WRITE(6,23)
      23 FORMAT(20M,SCAFAC,L11,TBATT,CR-ER)
      GO TO 1C
      24 RFACT=3048
      DENSITY=0.076473*PRATIO*(7.0+R1*PA)/(7.0+PVPA)
      CRATI=2.0*PA*PVPA/(7.0+PVPA)
      G0=(7.0+R1*PA)/SCAFAC/(R1*PA)
      CRATI=2.0*PA*PVPA/(7.0+PVPA)
      PAR1=(.715283*PVPA/1116.215+SCAFAC*PRATIO/(7.0+0.85714*PVPA))
      R1=PAR1*ACBLAC(L11)
      OTHERD,PZ
      ALTCM=L11*ALTCM,SCAFAC,L11,CRATI,DENSITY,SCFAT,BMCR,CR-ER
      25 FORMAT(1M +11E10.3)
      26 CR-ER=0.0
      STOP
      END

S1118/22  A:08:58  15/14/8  11079  COMPILER
 0 REC 26 SEC FOR COMPILETIME PASS
 02 CARD AT 03:58:4405 SEC-MINUTE
 1035 DIGITS DATA. 3388 DIGITS COST.

```

K. PRESSURE RATIO PRINTOUT

COST 2MIN												
VAL#	100E+01	080E+00	200E+00									
VAL# .970E+01	ALT	N	RKFT	0	CVP	DYNP	PARVEL	DENSITY	DENRAT	RHOU	OTHER	
.000E+00	.100E+01	.300E+00	.315E+03	.338E+03	.048E+03	.087E+04	.240E+00	.234E+01	.465E+03	.574E+01		
.305E+01	.100E+01	.348E+00	.252E+03	.377E+02	.697E+02	.181E+00	.182E+01	.325E+01	.332E+03	.570E+01		
.610E+01	.100E+01	.384E+00	.125E+03	.384E+02	.411E+02	.174E+00	.112E+00	.325E+01	.331E+03	.521E+01		
.915E+01	.100E+01	.461E+00	.133E+03	.250E+02	.281E+02	.167E+00	.931E+01	.325E+01	.156E+03	.571E+01		
.122E+02	.100E+01	.515E+00	.161E+03	.154E+02	.175E+02	.182E+00	.613E+01	.324E+01	.824E+02	.574E+01		
.152E+02	.100E+01	.631E+00	.768E+02	.970E+01	.109E+02	.162E+01	.382E+01	.324E+01	.621E+02	.570E+01		
.182E+02	.100E+01	.731E+00	.580E+02	.884E+01	.678E+01	.162E+03	.934E+01	.324E+01	.387E+02	.574E+01		
.213E+02	.970E+00	.859E+00	.468E+02	.374E+01	.420E+01	.163E+00	.147E+01	.325E+01	.239E+02	.571E+01		
.243E+02	.940E+00	.924E+00	.377E+02	.234E+01	.343E+01	.153E+00	.915E+01	.325E+01	.156E+03	.524E+01		
.274E+02	.910E+00	.1115E+01	.361E+02	.165E+01	.163E+01	.145E+00	.552E+02	.325E+01	.912E+01	.571E+01		
.305E+02	.880E+00	.1335E+01	.243E+02	.813E+00	.103E+01	.148E+00	.734E+02	.325E+01	.545E+01	.574E+01		
VAL# .240E+01	ALT	N	RKFT	0	CVP	DYNP	PARVEL	DENSITY	DENRAT	RHOU	OTHER	
.000E+00	.100E+01	.835E+00	.158E+03	.335E+02	.223E+02	.108E+00	.124E+00	.234E+01	.381E+03	.340E+01		
.305E+01	.100E+01	.515E+00	.115E+03	.243E+02	.155E+02	.106E+00	.129E+00	.228E+01	.130E+03	.240E+01		
.610E+01	.100E+01	.535E+00	.882E+02	.162E+02	.104E+02	.102E+00	.928E+01	.228E+01	.844E+02	.340E+01		
.915E+01	.100E+01	.681E+00	.610E+02	.105E+02	.670E+01	.975E+03	.653E+01	.228E+01	.636E+02	.240E+01		
.122E+02	.100E+01	.784E+00	.433E+02	.433E+01	.418E+01	.243E+03	.438E+01	.324E+01	.408E+02	.340E+01		
.152E+02	.100E+01	.932E+00	.351E+02	.409E+01	.261E+01	.945E+03	.268E+01	.224E+01	.255E+03	.260E+01		
.182E+02	.100E+01	.105E+01	.248E+02	.254E+01	.142E+01	.142E+03	.142E+01	.324E+01	.158E+02	.240E+01		
.213E+02	.970E+00	.137E+00	.214E+02	.137E+01	.100E+01	.949E+03	.101E+01	.220E+01	.979E+01	.240E+01		
.243E+02	.940E+00	.142E+01	.173E+02	.822E+00	.627E+00	.989E+03	.101E+01	.220E+01	.612E+01	.240E+01		
.274E+02	.910E+00	.170E+01	.138E+02	.468E+00	.308E+00	.984E+03	.843E+02	.220E+01	.373E+01	.240E+01		
.305E+02	.880E+00	.198E+01	.1115E+02	.345E+00	.244E+00	.981E+03	.235E+02	.220E+01	.931E+01	.340E+01		
VAL# .115E+01	ALT	N	RKFT	0	CVP	DYNP	PARVEL	DENSITY	DENRAT	RHOU	OTHER	
.000E+00	.100E+01	.400E+00	.530E+02	.181E+02	.282E+01	.223E+03	.344E+00	.174E+01	.973E+02	.430E+01		
.305E+01	.100E+01	.688E+00	.645E+02	.131E+02	.515E+01	.688E+03	.101E+00	.174E+01	.493E+02	.130E+03		
.610E+01	.100E+01	.787E+00	.673E+02	.384E+01	.442E+01	.722E+01	.378E+01	.482E+01	.130E+03	.340E+01		
.915E+01	.100E+01	.916E+00	.381E+02	.368E+01	.223E+01	.635E+03	.311E+01	.174E+01	.325E+02	.130E+03		
.122E+02	.100E+01	.100E+01	.255E+02	.255E+01	.135E+01	.814E+03	.222E+01	.174E+01	.708E+02	.130E+03		
.152E+02	.100E+01	.123E+01	.197E+02	.221E+01	.167E+00	.210E+03	.210E+01	.174E+01	.130E+02	.130E+01		
.182E+02	.100E+01	.138E+01	.142E+02	.138E+01	.548E+00	.814E+03	.133E+01	.174E+01	.808E+01	.340E+01		
.213E+02	.970E+00	.170E+01	.120E+02	.850E+00	.333E+00	.816E+03	.305E+02	.178E+01	.459E+01	.130E+01		
.243E+02	.940E+00	.198E+01	.955E+01	.532E+00	.208E+00	.813E+03	.505E+02	.174E+01	.312E+01	.340E+01		
.274E+02	.910E+00	.229E+02	.771E+01	.329E+00	.129E+00	.823E+03	.933E+02	.178E+01	.190E+01	.130E+03		
.305E+02	.880E+00	.241E+01	.623E+01	.204E+00	.814E+01	.811E+03	.146E+02	.174E+01	.118E+01	.130E+01		
VAL# .480E+00	ALT	N	RKFT	0	CVP	DYNP	PARVEL	DFNSTY	DENRAT	RHOU	OTHER	
.000E+00	.100E+01	.875E+00	.518E+02	.970E+01	.622E+01	.109E+00	.142E+01	.440E+02	.448E+00			
.305E+01	.100E+01	.987E+00	.314E+02	.887E+01	.144E+01	.406E+03	.809E+01	.143E+01	.328E+02	.640E+00		
.610E+01	.100E+01	.1115E+01	.231E+02	.644E+01	.541E+00	.181E+03	.574E+01	.143E+01	.328E+02	.640E+00		
.915E+01	.100E+01	.1316E+01	.166E+02	.339E+01	.222E+00	.375E+03	.610E+01	.143E+01	.154E+02	.660E+00		
.122E+02	.100E+01	.156E+01	.159E+02	.159E+01	.152E+00	.375E+03	.410E+01	.143E+01	.982E+01	.640E+00		
.152E+02	.100E+01	.177E+01	.112E+02	.112E+01	.242E+00	.385E+03	.167E+01	.143E+01	.615E+01	.660E+00		
.182E+02	.100E+01	.202E+01	.223E+01	.200E+00	.151E+00	.145E+03	.105E+01	.143E+01	.343E+01	.646E+00		
.213E+02	.970E+00	.243E+01	.632E+01	.830E+00	.363E+00	.136E+03	.653E+01	.143E+01	.236E+01	.650E+00		
.243E+02	.940E+00	.282E+01	.470E+01	.581E+00	.581E+00	.145E+03	.868E+01	.143E+01	.148E+03	.640E+00		
.274E+02	.910E+00	.327E+01	.375E+01	.167E+00	.380E+01	.370E+01	.742E+02	.143E+01	.921E+00	.660E+00		
.305E+02	.880E+00	.374E+01	.304E+01	.104E+00	.328E+01	.328E+01	.443E+02	.143E+01	.330E+00	.640E+00		
VAL# .460E+01	ALT	N	RKFT	0	CVP	DYNP	PARVEL	DFNSTY	DENRAT	RHOU	OTHER	
.000E+00	.100E+01	.399E+01	.200E+01	.270E+02	.227E+01	.512E+02	.801E+01	.105E+01	.410E+01	.660E+01		
.305E+01	.100E+01	.451E+01	.152E+01	.488E+00	.488E+01	.581E+03	.809E+01	.142E+01	.328E+02	.640E+01		
.610E+01	.100E+01	.510E+01	.110E+01	.486E+00	.104E+01	.275E+02	.427E+01	.105E+01	.293E+01	.640E+01		
.915E+01	.100E+01	.571E+01	.798E+01	.289E+02	.474E+02	.455E+02	.303E+01	.142E+01	.328E+01	.640E+01		
.122E+02	.100E+01	.648E+01	.382E+01	.493E+00	.141E+02	.384E+03	.610E+01	.143E+01	.144E+02	.660E+01		
.152E+02	.100E+01	.779E+01	.234E+01	.487E+00	.242E+02	.487E+03	.167E+01	.143E+01	.613E+01	.660E+01		
.182E+02	.100E+01	.968E+01	.160E+01	.484E+00	.421E+02	.484E+02	.168E+01	.105E+01	.479E+00	.660E+01		
.213E+02	.100E+01	.1125E+01	.142E+01	.482E+00	.343E+02	.343E+02	.144E+01	.143E+01	.343E+01	.660E+01		
.243E+02	.970E+00	.1375E+01	.107E+01	.343E+00	.107E+01	.343E+01	.474E+02	.143E+01	.239E+00	.644E+01		
.274E+02	.940E+00	.1279E+01	.224E+01	.270E+00	.335E+01	.335E+02	.298E+02	.105E+01	.132E+03	.660E+01		
.305E+02	.910E+00	.136E+02	.179E+00	.107E+01	.380E+01	.335E+02	.474E+02	.105E+01	.602E+01	.640E+01		
VAL# .400E+00	ALT	N	RKFT	0	CVP	DYNP	PARVEL	DFNSTY	DENRAT	RHOU	OTHER	
.000E+00	.100E+01	.319E+01	.233E+02	.338E+01	.708E+02	.275E+03	.972E+01	.127E+01	.398E+02	.800E+00		
.305E+01	.100E+01	.331E+01	.177E+02	.645E+01	.248E+01	.266E+03	.734E+01	.142E+01	.181E+02	.660E+00		
.610E+01	.100E+01	.350E+01	.130E+02	.271E+01	.366E+00	.255E+03	.510E+01	.127E+01	.133E+02	.800E+00		
.915E+01	.100E+01	.372E+01	.234E+01	.323E+01	.323E+00	.245E+03	.364E+01	.142E+01	.334E+01	.660E+00		
.122E+02	.100E+01	.406E+01	.713E+01	.105E+01	.108E+00	.239E+03	.240E+01	.127E+01	.570E+01	.800E+00		
.152E+02	.100E+01	.438E+01	.347E+01	.487E+00	.823E+01	.238E+03	.153E+01	.142E+01	.335E+01	.660E+00		
.182E+02	.100E+01	.478E+01	.278E+01	.484E+00	.574E+01	.238E+03	.122E+02	.142E+01	.223E+01	.800E+00		
.213E+02	.100E+01	.520E+01	.242E+01	.482E+00	.354E+01	.238E+03	.122E+02	.142E+01	.223E+01	.800E+00		
.243E+02	.970E+00	.375E+01	.263E+01	.104E+00	.227E+01	.238E+03	.122E+02	.142E+01	.639E+00	.800E+00		
.274E+02	.940E+00	.375E+01	.164E+00	.227E+01	.238E+03	.122E+02	.142E+01	.639E+00	.800E+00			
.305E+02	.910E+00	.301E+01	.171E+01	.632E+01	.888E+02	.248E+03	.121E+02	.142E+01	.323E+00	.800E+00		

L. SHOCK STRENGTH PRINTOUT

VALR	CUST	RPTN	ALT	HAF1	0	LVP	DYAP	PARVEL	DFSTY	DEHAT	RHO	DT-EH	
,100E+01	.000E+00	.200E+00	.000E+00	.100F+01	.300F+00	.325E+03	.43E+02	.50E+02	.10E+00	.245E+00	.325E+01	.465E+03	.670E+01
.305E+01	.100F+01	.340E+00	.252E+02	.57E+01	.64E+02	.11E+03	.18E+02	.18E+02	.12E+00	.124E+00	.131E+01	.674E+01	.674E+01
.410E+01	.100F+01	.390E+00	.185E+03	.342E+02	.423E+02	.17E+04	.34E+04	.34E+04	.124E+01	.124E+01	.124E+01	.670E+01	.671E+01
.914E+01	.100F+01	.100E+00	.133E+03	.144E+02	.200E+02	.10E+04	.10E+04	.10E+04	.124E+01	.124E+01	.124E+01	.670E+01	.670E+01
.122E+02	.100F+01	.535E+00	.101E+03	.17E+02	.175E+02	.162E+04	.613E+04	.613E+04	.124E+01	.124E+01	.124E+01	.670E+01	.670E+01
.152E+02	.100F+01	.631E+00	.745E+02	.970E+01	.109E+02	.142E+04	.30E+04	.32E+04	.124E+01	.124E+01	.124E+01	.670E+01	.670E+01
.182E+02	.100F+01	.773E+00	.580E+02	.674E+01	.747E+01	.162E+04	.23E+04	.23E+04	.124E+01	.124E+01	.124E+01	.670E+01	.670E+01
.213E+02	.100F+02	.857E+00	.606E+02	.373E+01	.418E+01	.162E+04	.16E+04	.16E+04	.124E+01	.124E+01	.124E+01	.670E+01	.670E+01
.243E+02	.940E+00	.994E+00	.577E+02	.231E+01	.202E+01	.142E+04	.619E+04	.619E+04	.124E+01	.124E+01	.124E+01	.670E+01	.670E+01
.274E+02	.910E+00	.1119E+01	.301E+02	.144E+01	.162E+01	.145E+04	.551E+04	.551E+04	.124E+01	.124E+01	.124E+01	.670E+01	.670E+01
.305E+02	.860E+00	.1337E+01	.243E+02	.914E+01	.103E+01	.164E+04	.335E+04	.335E+04	.124E+01	.124E+01	.124E+01	.670E+01	.670E+01
VALR	CUST	RPTN	ALT	HAF1	0	LVP	DYAP	PARVEL	DFSTY	DEHAT	RHO	DT-EH	
.000E+00	.100F+01	.654E+00	.150E+03	.315E+02	.225E+02	.10E+04	.17E+04	.17E+04	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01
.305E+01	.100F+01	.515E+00	.115E+03	.272E+02	.155E+02	.10E+04	.120E+04	.120E+04	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01
.410E+01	.100F+01	.534E+00	.349E+02	.115E+02	.103E+02	.102E+04	.924E+04	.924E+04	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01
.914E+01	.100F+01	.691E+00	.601E+02	.115E+02	.974E+01	.223E+03	.122E+04	.122E+04	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01
.122E+02	.100F+01	.770E+00	.486E+02	.655E+01	.417E+01	.144E+03	.43U+01	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01	
.152E+02	.100F+01	.834E+00	.351E+02	.441E+01	.240E+01	.164E+03	.264E+01	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01	
.182E+02	.100F+01	.100E+01	.266E+02	.244E+01	.162E+01	.162E+03	.944E+03	.162E+01	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01
.213E+02	.940E+00	.127E+01	.214E+02	.157E+01	.100E+01	.143E+03	.104E+01	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01	
.243E+02	.940E+00	.141E+01	.173E+02	.940E+00	.625E+00	.162E+03	.944E+03	.162E+01	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01
.274E+02	.910E+00	.175E+01	.133E+02	.607E+00	.367E+00	.162E+03	.3A5E+03	.3A5E+03	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01
.305E+02	.860E+00	.190E+01	.111E+02	.344E+00	.245E+00	.162E+03	.235E+03	.235E+03	.122E+01	.122E+01	.122E+01	.340E+01	.340E+01
VALR	CUST	RPTN	ALT	HAF1	0	LVP	DYAP	PARVEL	DFSTY	DEHAT	RHO	DT-EH	
.000E+00	.100F+01	.600E+00	.650E+02	.191E+02	.750E+01	.113E+03	.113E+03	.113E+03	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.305E+01	.100F+01	.600E+00	.650E+02	.131E+02	.515E+01	.683E+03	.101E+04	.101E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.410E+01	.100F+01	.747E+00	.472E+02	.679E+01	.344E+01	.662E+03	.72E+01	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.914E+01	.100F+01	.914E+00	.341E+02	.566E+01	.223E+01	.635E+03	.51E+01	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.122E+02	.100F+01	.100E+00	.255E+02	.555E+01	.159E+01	.615E+03	.174E+01	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.152E+02	.100F+01	.122E+01	.197E+02	.471E+01	.106E+01	.164E+03	.711E+01	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.182E+02	.100F+01	.140E+01	.137E+02	.437E+01	.133E+01	.164E+03	.533E+01	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.213E+02	.970E+00	.175E+01	.120E+02	.405E+01	.133E+00	.164E+03	.333E+00	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.243E+02	.940E+00	.195E+01	.140E+01	.595E+01	.332E+00	.208E+00	.105E+00	.164E+03	.105E+00	.127E+01	.127E+01	.230E+01	.230E+01
.274E+02	.910E+00	.216E+01	.127E+01	.771E+01	.324E+00	.129E+00	.605E+00	.164E+03	.605E+00	.127E+01	.127E+01	.230E+01	.230E+01
.305E+02	.860E+00	.243E+01	.102E+01	.623E+01	.20E+00	.164E+03	.164E+03	.164E+03	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
VALR	CUST	RPTN	ALT	HAF1	0	LVP	DYAP	PARVEL	DFSTY	DEHAT	RHO	DT-EH	
.000E+00	.100F+01	.545E+00	.417E+02	.571E+01	.209E+01	.971E+03	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.305E+01	.100F+01	.490E+00	.318E+02	.515E+01	.144E+01	.405E+03	.404E+01	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.410E+01	.100F+01	.513E+00	.231E+02	.446E+01	.162E+01	.361E+03	.584E+01	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.914E+01	.100F+01	.691E+00	.131E+02	.160E+02	.255E+01	.421E+04	.373E+03	.41V+03	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.122E+02	.100F+01	.153E+00	.120E+02	.120E+01	.120E+00	.174E+04	.363E+02	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.152E+02	.100F+01	.174E+01	.107E+02	.107E+01	.107E+00	.174E+04	.271E+02	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.182E+02	.100F+01	.194E+01	.950E+01	.950E+01	.950E+00	.174E+04	.242E+02	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.213E+02	.100F+01	.207E+01	.723E+01	.689E+01	.689E+00	.174E+04	.305E+02	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.243E+02	.100F+01	.220E+01	.585E+01	.585E+01	.585E+00	.174E+04	.345E+02	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.274E+02	.100F+01	.235E+01	.375E+01	.375E+01	.375E+00	.174E+04	.360E+02	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
.305E+02	.100F+01	.250E+01	.303E+01	.303E+01	.303E+00	.174E+04	.228E+02	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01	
VALR	CUST	RPTN	ALT	HAF1	0	LVP	DYAP	PARVEL	DFSTY	DEHAT	RHO	DT-EH	
.000E+00	.100F+01	.510E+00	.210E+02	.210E+01	.210E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.305E+01	.100F+01	.464E+00	.131E+02	.131E+01	.131E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.410E+01	.100F+01	.484E+00	.121E+02	.121E+01	.121E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.914E+01	.100F+01	.691E+00	.121E+02	.121E+01	.121E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.122E+02	.100F+01	.741E+00	.203E+02	.203E+01	.203E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.152E+02	.100F+01	.817E+00	.231E+02	.231E+01	.231E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.182E+02	.100F+01	.874E+00	.231E+02	.231E+01	.231E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.213E+02	.100F+01	.914E+00	.231E+02	.231E+01	.231E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.243E+02	.100F+01	.934E+00	.231E+02	.231E+01	.231E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.274E+02	.100F+01	.949E+00	.231E+02	.231E+01	.231E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.305E+02	.100F+01	.964E+00	.231E+02	.231E+01	.231E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
VALR	CUST	RPTN	ALT	HAF1	0	LVP	DYAP	PARVEL	DFSTY	DEHAT	RHO	DT-EH	
.000E+00	.100F+01	.501E+00	.177E+02	.177E+01	.177E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.305E+01	.100F+01	.455E+00	.131E+02	.131E+01	.131E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.410E+01	.100F+01	.475E+00	.121E+02	.121E+01	.121E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.914E+01	.100F+01	.691E+00	.121E+02	.121E+01	.121E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.122E+02	.100F+01	.741E+00	.203E+02	.203E+01	.203E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.127E+01	.230E+01	.230E+01
.152E+02	.100F+01	.817E+00	.231E+02	.231E+01	.231E+00	.275E+04	.113E+04	.113E+04	.127E+01	.127E+01	.1		

M. DENSITY PRINTOUT

VAL	CUST		RMH.L		
.100E+01		.000E+00		.200E+00	
FAILED TO CONVERGE.					
.144E-01	.100E+01	.000E+00	.19E+04	.000E+00	
.122E-02	.100E+01	.000E+00	.119E+04	.000E+00	
.152E-02	.100E+01	.000E+00	.119E+04	.000E+00	
.162E-02	.100E+01	.000E+00	.119E+04	.000E+00	
.212E-02	.070E+00	.000E+00	.119E+04	.000E+00	
.243E-02	.040E+00	.000E+00	.119E+04	.000E+00	
.274E-02	.010E+00	.000E+00	.119E+04	.000E+00	
.305E-02	.000E+00	.000E+00	.119E+04	.000E+00	
VAL = .300E+00					
ALT	RKFI		Q	UVF	DYHP
.000E+00	.100E+01	.000E+00	.500E+03	.145E+03	.211E+03
.305E+01	.100E+01	.000E+00	.119E+04	.441E+03	.951E+03
.610E+01	.100E+01	.000E+00	.119E+04	.000E+00	.542E+04
					DYSEL PARVEL DENSIT DEMRAT RMHU OTHER
					.30E+00 .392E+01 .766E+03 .300E+00
					.100E+01 .000E+00 .287E+01
					.100E+01 .000E+00 .166E+00 .130E+01
					.100E+01 .000E+00 .114E+01 .114E+01
					.100E+01 .000E+00 .73E+02 .73E+02
					.100E+01 .000E+00 .433E+02 .433E+02
					.100E+01 .000E+00 .283E+02 .283E+02
					.100E+01 .000E+00 .170E+02 .170E+02
					.100E+01 .000E+00 .103E+00 .103E+00
VAL = .200E+00					
ALT	RKFI		Q	UVF	DYHP
.000E+00	.100E+01	.391E+00	.20E+03	.900E+02	.390E+02
.305E+01	.100E+01	.313E+00	.313E+03	.030E+02	.207E+04
.610E+01	.100E+01	.222E+00	.580E+03	.146E+03	.329E+03
					DYSEL PARVEL DENSIT DEMRAT RMHU OTHER
					.20E+00 .390E+04 .200E+00 .271E+01
					.100E+01 .000E+00 .354E+03 .415E+03
					.100E+01 .000E+00 .200E+00 .200E+00
					.100E+01 .000E+00 .103E+00 .103E+00
FAILED TO CONVERGE.					
.122E+02	.100E+01	.000E+00	.535E+13	.000E+00	
.152E+02	.100E+01	.000E+00	.580E+13	.000E+00	
.162E+02	.100E+01	.000E+00	.580E+13	.000E+00	
.212E+02	.97E+00	.000E+00	.580E+13	.000E+00	
.243E+02	.94E+00	.000E+00	.580E+13	.000E+00	
.274E+02	.91E+00	.000E+00	.580E+13	.000E+00	
.305E+02	.88E+00	.000E+00	.580E+13	.000E+00	
VAL = .150E+00					
SLT	RKFI		Q	UVF	DYHP
.000E+00	.100E+01	.97E+00	.109E+03	.245E+02	.188E+02
.305E+01	.100E+01	.43E+00	.121E+03	.350E+02	.290E+02
.610E+01	.100E+01	.342E+00	.248E+03	.545E+02	.730E+02
.915E+01	.100E+01	.221E+00	.577E+03	.149E+03	.357E+03
					DYSEL PARVEL DENSIT DEMRAT RMHU OTHER
					.150E+00 .103E+01 .326E+03 .150E+00
					.100E+01 .000E+00 .264E+01 .264E+01
					.100E+01 .000E+00 .358E+03 .319E+03
					.100E+01 .000E+00 .150E+00 .150E+00
FAILED TO CONVERGE.					
.152E+02	.100E+01	.000E+00	.577E+03	.000E+00	
.172E+02	.100E+01	.000E+00	.577E+03	.000E+00	
.213E+02	.97E+00	.000E+00	.577E+03	.000E+00	
.243E+02	.94E+00	.000E+00	.577E+03	.000E+00	
.274E+02	.91E+00	.000E+00	.577E+03	.000E+00	
.305E+02	.88E+00	.000E+00	.577E+03	.000E+00	
VAL = .100E+00					
SLT	RKFI		Q	UVF	DYHP
.000E+00	.100E+01	.145E+01	.776E+02	.073E+01	.103E+01
.305E+01	.100E+01	.695E+00	.633E+02	.124E+02	.600E+00
.610E+01	.100E+01	.54E+00	.950E+02	.104E+02	.141E+02
.915E+01	.100E+01	.382E+00	.157E+03	.304E+02	.378E+02
.122E+02	.100E+01	.252E+00	.668E+03	.135E+03	.297E+03
.152E+02	.100E+01	.200E+00	.668E+03	.030E+02	.212E+04
.192E+02	.100E+01	.100E+00	.668E+03	.000E+00	.150E+00
.232E+02	.100E+01	.50E+00	.668E+03	.000E+00	.100E+00
.274E+02	.100E+01	.25E+00	.668E+03	.000E+00	.50E+00
.314E+02	.100E+01	.10E+00	.668E+03	.000E+00	.10E+00
.355E+02	.100E+01	.5E+00	.668E+03	.000E+00	.5E+00
					DYSEL PARVEL DENSIT DEMRAT RMHU OTHER
					.100E+01 .000E+00 .523E+01 .704E+03
					.100E+01 .000E+00 .150E+00 .150E+00
FAILED TO CONVERGE.					
.152E+02	.100E+01	.000E+00	.577E+03	.000E+00	
.172E+02	.100E+01	.000E+00	.577E+03	.000E+00	
.213E+02	.97E+00	.000E+00	.577E+03	.000E+00	
.243E+02	.94E+00	.000E+00	.577E+03	.000E+00	
.274E+02	.91E+00	.000E+00	.577E+03	.000E+00	
.305E+02	.88E+00	.000E+00	.577E+03	.000E+00	
VAL = .050E+00					
SLT	RKFI		Q	UVF	DYHP
.000E+00	.100E+01	.145E+01	.776E+02	.073E+01	.103E+01
.305E+01	.100E+01	.695E+00	.633E+02	.124E+02	.600E+00
.610E+01	.100E+01	.54E+00	.950E+02	.104E+02	.141E+02
.915E+01	.100E+01	.382E+00	.157E+03	.304E+02	.378E+02
.122E+02	.100E+01	.252E+00	.668E+03	.135E+03	.297E+03
.152E+02	.100E+01	.200E+00	.668E+03	.030E+02	.212E+04
.192E+02	.100E+01	.100E+00	.668E+03	.000E+00	.150E+00
.232E+02	.100E+01	.50E+00	.668E+03	.000E+00	.100E+00
.274E+02	.100E+01	.25E+00	.668E+03	.000E+00	.50E+00
.314E+02	.100E+01	.10E+00	.668E+03	.000E+00	.10E+00
.355E+02	.100E+01	.5E+00	.668E+03	.000E+00	.5E+00
					DYSEL PARVEL DENSIT DEMRAT RMHU OTHER
					.100E+01 .000E+00 .523E+01 .704E+03
					.100E+01 .000E+00 .150E+00 .150E+00
V4 = .050E+01					
SLT	RKFI		Q	UVF	DYHP
.000E+00	.100E+01	.12E+01	.727E+02	.073E+01	.103E+01
.305E+01	.100E+01	.74E+00	.545E+02	.117E+02	.372E+01
.610E+01	.100E+01	.62E+00	.691E+02	.121E+02	.105E+02
.915E+01	.100E+01	.45E+00	.121E+03	.304E+02	.171E+04
.122E+02	.100E+01	.252E+00	.668E+03	.135E+03	.297E+03
.152E+02	.100E+01	.200E+00	.668E+03	.030E+02	.212E+04
.192E+02	.100E+01	.100E+00	.668E+03	.000E+00	.150E+00
.232E+02	.100E+01	.50E+00	.668E+03	.000E+00	.100E+00
.274E+02	.100E+01	.25E+00	.668E+03	.000E+00	.50E+00
.314E+02	.100E+01	.10E+00	.668E+03	.000E+00	.10E+00
.355E+02	.100E+01	.5E+00	.668E+03	.000E+00	.5E+00
					DYSEL PARVEL DENSIT DEMRAT RMHU OTHER
					.100E+01 .000E+00 .523E+01 .704E+03
					.100E+01 .000E+00 .150E+00 .150E+00
FAILED TO CONVERGE.					
.152E+02	.100E+01	.000E+00	.355E+03	.000E+00	
.172E+02	.100E+01	.000E+00	.355E+03	.000E+00	
.213E+02	.97E+00	.000E+00	.355E+03	.000E+00	
.243E+02	.94E+00	.000E+00	.355E+03	.000E+00	
.274E+02	.91E+00	.000E+00	.355E+03	.000E+00	
.305E+02	.88E+00	.000E+00	.355E+03	.000E+00	
VAL = .750E+01					
SLT	RKFI		Q	UVF	DYHP
.000E+00	.100E+01	.725E+02	.496E+01	.011E+00	.318E+03
.305E+01	.100E+01	.545E+00	.545E+02	.117E+02	.600E+00
.610E+01	.100E+01	.62E+00	.691E+02	.121E+02	.105E+02
.915E+01	.100E+01	.45E+00	.121E+03	.304E+02	.171E+04
.122E+02	.100E+01	.252E+00	.668E+03	.135E+03	.297E+03
.152E+02	.100E+01	.200E+00	.668E+03	.030E+02	.212E+04
.192E+02	.100E+01	.100E+00	.668E+03	.000E+00	.150E+00
.232E+02	.100E+01	.50E+00	.668E+03	.000E+00	.100E+00
.274E+02	.100E+01	.25E+00	.668E+03	.000E+00	.50E+00
.314E+02	.100E+01	.10E+00	.668E+03	.000E+00	.10E+00
.355E+02	.100E+01	.5E+00	.668E+03	.000E+00	.5E+00
					DYSEL PARVEL DENSIT DEMRAT RMHU OTHER
					.100E+01 .000E+00 .318E+03 .750E+01
					.100E+01 .000E+00 .150E+00 .150E+00
FAILED TO CONVERGE.					
.152E+02	.100E+01	.000E+00	.135E+03	.000E+00	
.172E+02	.100E+01	.000E+00	.135E+03	.000E+00	
.213E+02	.97E+00	.000E+00	.135E+03	.000E+00	
.243E+02	.94E+00	.000E+00	.135E+03	.000E+00	
.274E+02	.91E+00	.000E+00	.135E+03	.000E+00	
.305E+02	.88E+00	.000E+00	.135E+03	.000E+00	

N. THERMAL FLUX PROGRAM

THERMAL FLUX PROGRAM

```

      50HDSAX, UNIT = READCH
      DIMENSION HDBKH(11), VAL(11)
      5 READ(5,1) H'COST,R,IH,IVAL
      7 FORMAT(3E10.3,2I2)
      READ(5,1) (HDBKH(I)+IH*IH)
      3 FOPEN(0+10,3)
      HEAD(5,3) (VAL(1),3=1,IVAL)
      CALL CLOSE(5,2HFR)
      NLINE(6,4)
      4 FORMAT(3DH      COST      RHIN      )
      NK(1F(6,5) H'CUST,R
      5 FORMAT(3E10.3)
      NKIN=R
      N18N
      GO TO 1=IVAL
      NKIE(4,9) VAL(1)
      9 FORMAT(5H0VAL=10.5)
      NKIF(4,7)
      7 FORMAT(1DH     ALI      RKT      Q      RVP      RT
      18P    PARVEL   DENSITY   DEMAT   RHOU   OTHER )
      OTHERD,
      RHIN
      OR SO J=1,IH
      NKINTO
      ALTCH=HDBKH(J)*1.E3
      CALL ARDC(ALTCH,PRATIO,TRATIO,RATIO)
      PRATIO=HAT20*13.696
      PCRPATIO=1.01325E+6
      R=1
      C THIS IS THE SCALING FACTOR FOR IKT.
      SCAFACT=.37-(.09/9.144)*HDBKH(J)
      IF(HDBKH(J)=.9+.144)SCAFAC=.33+(.04/9.144)*(HDBKH(J)-.144)
      IF(HDBKH(J)=.67+.1A22)SCAFAC=.37+(.15/12.19)*(HDBKH(J)-.1522)
      C REMOVE THE NEXT CARD IF INTERPOLATING FOR THERMAL ENERGY
      IF(COST=.824.0
      8 ALT=HDBKH(J)*R*COST
      CUST=COSINE THET=0.0, FILE NUMBER AND
      IF(IKT,GT,0.0) GO TO 12
      ALT=0.
      R=HDBKH(J)/CUST
      12 ALTCH=ALT*1.E3
      CALL ARDC(ALTCH,PRATIO,TRATIO,RATIO)
      24 PRACT=1./PRATIO
      13 RFACT=(1./PRACT)*.33333333
      R=1/R*PRACT
      CALL RP1271(P14T,P1KT)
      C,P=P14T/PRFACT
      PRATIO=1./PRATIO=13.696
      PUPVPA=1.P/PSIA10
      C=DSTY*(.078475*DRATIO/(7.0+6.0*PUPVPA)/(7.0+PCUPA)
      C=7.94E-12*SCAFAC)/(H=H)
      16 IF(H=H) 17,17,20
      17 P14T
      R1KT
      R2=0.H
      RCUST=1
      GU IN 4
      20 R2=0

      R2=0
      R2=1/2
      M1=P1/2
      C=M1*(1/P1
      R=ALG(R1M1)
      E=ALG(R2M2)
      C=C*LGE(C/C)
      S=HMA(C/C)
      R=1.0E-6*(ACB)
      P14T2
      R1KT2
      18 (R1KT2=R2)+(R1KT2*R2) 14+14.21
      21 R2=0.000140471
      IF(R2=0.000140471) 0=0.22
      22 R2=0.000140471
      23 R1KT2=(2040*FAILLU TV CONVERG+1
      5L. TO 5U
      14 R2=0.000140471
      PUPVPA=.000P*UPP/(7.0*PSIA10*CPVPA)
      DLXH=AL(7.0*PSIA10*CPVPA)/(7.0*PUPVPA)
      PSIA10=.713225E+02*1116.215*PSIA10*AT10/(1.0+0.85714*PUPVPA)
      PUPVPA=PSIA10*DE10*STT
      LTHEDPZ
      R1KT2=0.000140471 ALT,H=H,RKT,Q=0,P=0,T=0,V=0,DENSTY,DEMAT,HHOU,0,1,0
      15 FOPEN(1H+11E10,3)
      50 CONTINUE
      STOP
      END

01/31/72 12:33 PM ASHRAE,3 13172 COMPILER
0 K15 50 SFC FOR COMPILED PASS
01 CARDS AT .001 CARDS PER MINUTE
1582 BYTES DATA, 3054 DIGITS CORE.

```

O. THERMAL FLUX PRINTOUT